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Vol. 73, No. 3 SEPTEMBER 1961 Pages 225–328

HOODED MERGANSER BEHAVIOR (photograph) ..... facing page 227

THE SEXUAL BEHAVIOR AND SYSTEMATIC POSITION OF THE HOODED MERGANSER ..... *Paul A. Johnsgard* 227

REPRODUCTIVE BEHAVIOR OF RED-BELLIED WOODPECKERS ..... *Lawrence Kilham* 237

NESTING SUCCESS CALCULATED FROM EXPOSURE ..... *Harold Mayfield* 255

KERMADEC PETREL IN PENNSYLVANIA ..... *Donald S. Heintzelman* 262

OCCURRENCE AND TIMING OF EGG TEETH IN BIRDS ..... *George A. Clark, Jr.* 268

GENERAL NOTES

DORSAL APTERIUM PRESENT IN BOBWHITE ..... *Lucy Sharp Brewer* 279

COPULATORY BEHAVIOR OF THE COMMON LOON ..... *William E. Southern* 280

CATTLE EGRETS IN MEXICO ..... *Robert F. Andrle and Harold H. Axtell* 280

LONG-TAILED JAEGER IN OHIO ..... *Edwin Novotny* 280

PURPLE MARTINS NESTING IN CITY BUILDINGS ..... *John William Hardy* 281

ORNITHOLOGICAL NEWS 282

JOSSELYN VAN TYNE MEMORIAL LIBRARY 283

CONSERVATION SECTION: STATUS AND PROBLEMS OF NORTH AMERICAN GROUSE ..... *Frederick and Frances Hamerstrom* 284

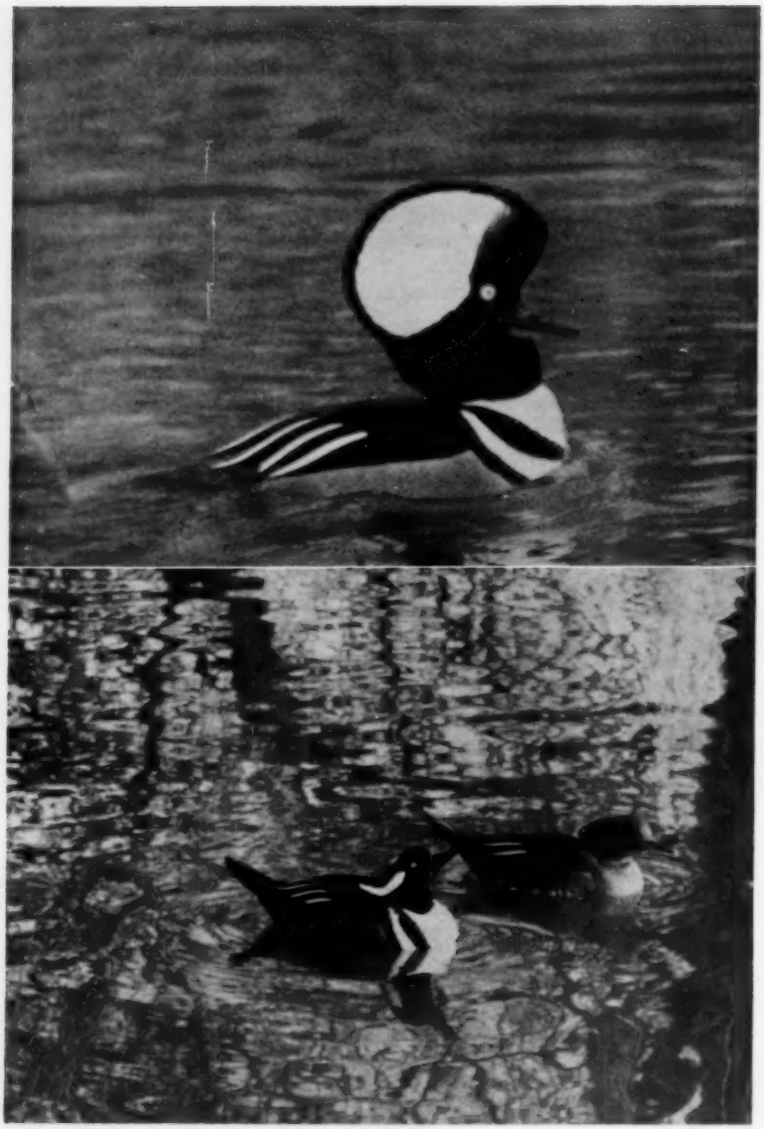
ORNITHOLOGICAL LITERATURE 295

Thomas S. Roberts, *Bird Portraits in Color*, reviewed by Olin Sewall Pettingill, Jr.; George Miksch Sutton, *Iceland Summer: Adventures of a Bird Painter*, reviewed by Rosario Mazzeo; George C. Munro, *Birds of Hawaii*, reviewed by Olin Sewall Pettingill, Jr.; Thomas Gilbert Pearson, Clement Samuel Brimley, and Herbert Hutchinson Brimley, *Birds of North Carolina*, reviewed by Olin Sewall Pettingill, Jr.; George H. Lowery, Jr., *Louisiana Birds*, reviewed by Olin Sewall Pettingill, Jr.; Henry Marion Hall, *A Gathering of Shorebirds*, reviewed by Olin Sewall Pettingill, Jr.; K. H. Voous, *Atlas of European Birds*, reviewed by E. M. Reilly, Jr.; Herbert Friedmann, *The Parasitic Weaverbirds*, reviewed by Andrew J. Berger; G. Bergman, K. O. Donner, and L. von Haartman, editors, *XII International Ornithological Congress, Helsinki 5–12. VI. 1958. Proceedings*, reviewed by Paul H. Baldwin; Donald J. Borror and William W. H. Gunn, *Songs of Fringillidae of Eastern and Central North America*, reviewed by Harold H. Axtell; Paul Slud, *The Birds of Finca "La Selva," Costa Rica: A Tropical Wet Forest Locality*, reviewed by Raymond A. Paynter, Jr.; James Bond, *Birds of the West Indies*, reviewed by Raymond A. Paynter, Jr.; Stephanie Ryder, *Blind Jack*, reviewed by Sally F. Hoyt; R. Meinertzhagen, *Pirates and Predators: The Piratical and Predatory Habits of Birds*, reviewed by Olin Sewall Pettingill, Jr.; South African Ornithological Society, *Proceedings of the First Pan-African Ornithological Congress*, reviewed by John T. Emlen, Jr.; Eleanor Rice Pettingill, *Penguin Summer: An Adventure with the Birds of the Falkland Islands*, reviewed by Florence Page Jaques.

PUBLICATION NOTES AND NOTICES 309

ANNUAL REPORT OF THE CONSERVATION COMMITTEE ..... *Thomas G. Scott* 310

PROCEEDINGS OF THE FORTY-SECOND ANNUAL MEETING ..... *Aaron M. Bagg* 320



Hooded Merganser behavior.
(Above) Crest-raising by male. (Below) Precopulatory drinking by male.

THE SEXUAL BEHAVIOR AND SYSTEMATIC POSITION OF THE HOODED MERGANSER

PAUL A. JOHNSGARD

IT has been over 15 years since Delacour and Mayr (1945) first urged that the mergansers (*Mergus*) and the goldeneye-Bufflehead group (*Bucephala*) be merged into a single tribe (Mergini) rather than being maintained in separate subfamilies (Aythyinae and Merginae). Their reasons for this change were several, and included such points as the similarities in the downy young, female color patterns, occurrence of wild hybrids between the two genera, and tracheal structure. Indeed, except for the shape of the bill in these two groups there is no good means of distinguishing the two subfamilies. As Delacour and Mayr pointed out, bill shape and structure is highly adaptive and should not be used for the erection of major taxonomic categories. However, these two subfamilies are still upheld in the fifth edition of the AOU Check-list.

Delacour and Mayr described the general similarities in the sexual behavior of *Mergus* and *Bucephala*, but no one has yet had the opportunity of critically comparing the behavior of most species in the two groups. Myres (1957, 1959*a*, 1959*b*) reviewed well the behavior of the *Bucephala* species, but was not fortunate enough to compare directly copulatory behavior in this genus and *Mergus*. He has, however, provided detailed descriptions of courtship and copulation in the Common Goldeneye (*B. clangula*), Barrow's Goldeneye (*B. islandica*), and Bufflehead (*B. albeola*). The behavior of the Common Goldeneye has also recently been described by Dane et al. (1959) and Lind (1960). I have been able to observe closely courtship display in all three species of *Bucephala* and in four species of *Mergus*, including the Hooded Merganser (*M. cucullatus*), Smew (*M. albellus*), Red-breasted Merganser (*M. serrator*) and Common Merganser (*M. merganser*), both in the wild (Johnsgard, 1955) and under captive conditions at the Wildfowl Trust, Slimbridge, England. Here I also have observed copulatory behavior in the Common Goldeneye, Barrow's Goldeneye, Hooded Merganser, Smew, and Common Merganser, and have incomplete observations on the Red-breasted Merganser. Although a major summary of my observations on these species and the rest of the Anatidae will be published later, the following observations on the Hooded Merganser are of special interest and have a direct bearing on Delacour and Mayr's (1945) proposed classification.

OBSERVATIONS OF BEHAVIOR

Aside from the notes of Bagg and Eliot (1933), Harper (*in* Phillips, 1926) and Robb (1930), relatively little has been written on the courtship of the Hooded Merganser, and nothing has been noted regarding copulatory behavior. In the Anatidae, behavior associated with copulation is very conservative and

thus is extremely useful in judging evolutionary relationships (Myres, 1959*b*, Johnsgard, 1960). The following behavioral patterns associated with courtship, or pair formation, have been observed by me:

Male Courtship. (1) Crest-raising (Front.). This is frequently performed, and may occur without other displays or in combination with them. Crest-raising also occurs in the Bufflehead and, in a less spectacular fashion, in the other species of *Bucephala* and *Mergus*.

(2) Head-shaking (Fig. 1). This is a rapid lateral shaking with crest raised, and is repeated three or four times before the Head-throw display. It serves the same function as does the "Introductory shake" of *Anas*, in that it draws attention to a male that is about to perform an elaborate display. Similar shaking movements occur in the Red-breasted Merganser and the Smew.

(3) Head-throw with Turning-the-back-of-the-head (Fig. 1). This is the most elaborate of the male courtship displays. It is directed to a particular female, to which the displaying male is usually parallel. The head is rapidly brought back to the back with crest erect and a call, a rolling frog-like *Crrrroooooo* is uttered as the head is returned to the normal position and the crest is turned toward the courted female. I have never seen a kick accompany this display. Head-throws also occur in the Common and Barrow's Goldeneyes and in the Smew, but it is doubtful that these displays are all homologous, since Head-throw displays have clearly evolved independently in many genera of ducks (*Anas*, *Aythya*, *Clangula*, *Somateria*, etc.). Sometimes after several Head-shakes the male does not perform a Head-throw but only lifts his head, opens his bill, and utters a hollow *pop*. I know of no similar behavior in any other species.

(4) Pumping (Fig. 1). A frequent and silent display which appears to be aggressive in motivation is an upward and forward stretching of the neck which results in an elliptical movement of the head and bill, as if the bird were reaching for an invisible object. This is often repeated and is sometimes performed simultaneously in both sexes. None of the other *Mergus* species studied have such displays, but the Rotary Pumping of Barrow's Goldeneyes and the Bowsprit Pumping of the Common Goldeneye (see Myres, 1959*a*) are similar in form and also appear to be hostile in motivation.

(5) Upward-stretch. This is a simple Head-shaking stretch with an erect crest. It is often done by displaying males and is clearly ritualized. Similar movements occur in all species of *Bucephala* and *Mergus* observed by me and likewise appear to be ritualized into displays.

(6) Upward-stretch with Wing-flapping. This is like the preceding display but the wings are also flapped several times. This display is found in all the species of *Bucephala* (especially the Bufflehead, in which it is certainly one of the major displays) and also in all the *Mergus* species observed by me.

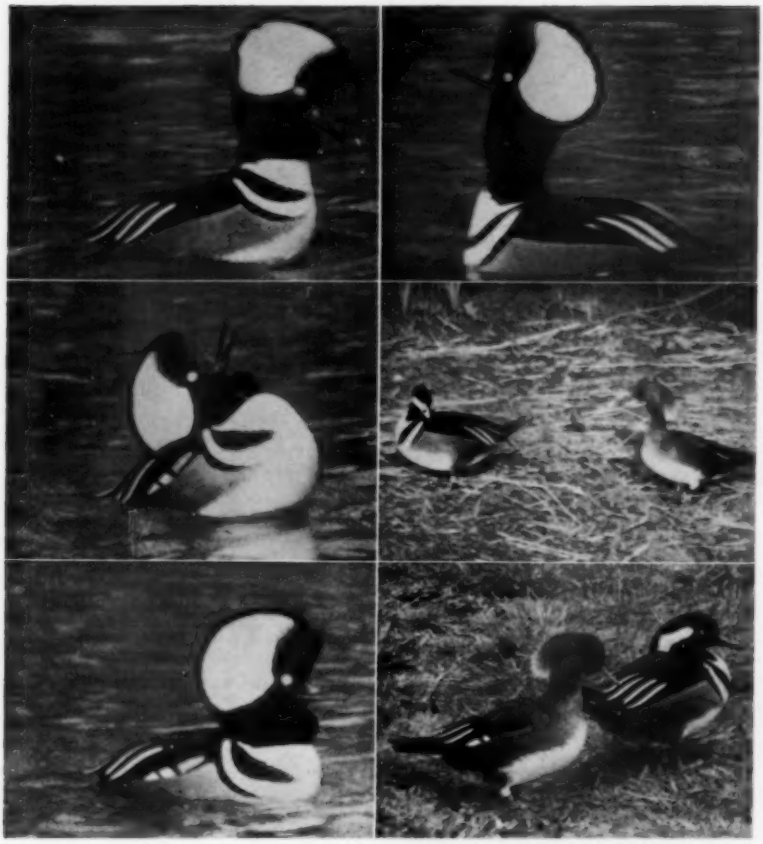


FIG. 1. Courtship displays of Hooded Merganser.

(Upper Left) Head-shaking.
(Center Left) Head-throw.
(Lower Left) Turning-the-back-of-the-head after the Head-throw.
(Upper Right) Pumping.
(Center Right) Male with crest depressed and directed toward female, who is performing "Bobbing" movements.
(Lower Right) Low-intensity "Bobbing" by female.

(7) Drinking (Front.). Ritualized drinking with a depressed crest occurs as a courtship (and precopulatory) display in the Hooded Merganser, the Smew, and to a lesser degree in the other mergansers. In *Bucephala* it is primarily a precopulatory display. In the Hooded Merganser it may be distinguished from normal drinking in that the bill is raised almost to the vertical and the crest is strongly depressed.

(8) Tail-cocking. This display occurs in the Hooded Merganser in association with the following display, which appears to be related to pair-bond maintenance. The male usually swims ahead of the female with his tail cocked at about a 45-degree angle. Similar displays occur in the Smew and in the Common and Red-breasted Mergansers, but I have not seen it in males of *Bucephala*.

(9) Crest-depressed and directed toward female (Fig. 1). This is similar to the Turning-of-the-back-of-the-head display in male *Anas* (Lorenz, 1951–53) and is distinct from the usual head profile of a resting or frightened bird in that the forehead feathers are raised and the crest itself is strongly depressed. A very similar display occurs in the Smew (but in this species the color pattern produced is a black "V" against a white head rather than a white "V" against a black head).

(10) Tertial-lifting. This is a slight and often-repeated lifting of the ornamental tertials while performing displays (8) and (9). I have not observed it in any other species, and am uncertain whether the movement actually has a signal function.

Female Courtship. (1) "Bobbing" (Fig. 1). This is the term used by Hollom (1937) for a display in the female Smew that is obviously homologous to this movement of the Hooded Merganser. It is clearly an especially intensive form of inciting (see Lorenz, 1951–53), in which the female's head moves in a jerky, upward bobbing fashion, with the bill pointed downward, as a hoarse *Gack* is uttered. It is rather rare in the Hooded Merganser, but is very frequent in the Smew. I have also observed this type of inciting in the Red-breasted Merganser, but in the Common Merganser inciting takes a form more like the inciting of pochards (*Aythya*) and dabbling ducks (*Anas*), in that the "bobbing" component is not so conspicuous. Inciting in goldeneyes ("Jiving" of Myres, 1957, 1959*a*) has a markedly different form, but the equivalent behavior of Buffleheads ("Following") is more like the typical *Mergus* type of inciting. The male response in all these species is the same, namely to swim ahead of the inciting female while directing the back of his head toward her.

(2) Pumping. This is identical to Pumping in the male and is usually performed in response to male Pumping in the same way that female goldeneyes respond to Rotary and Bowsprit Pumping by males.

Precopulatory and Postcopulatory Behavior. In *Bucephala* as well as *Mergus*

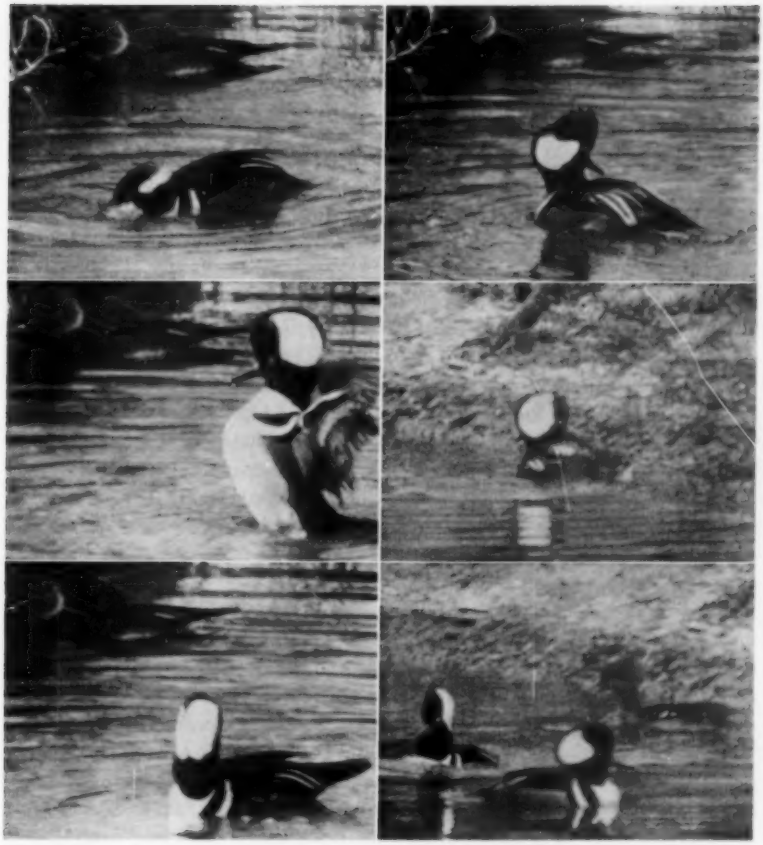


FIG. 2. Copulatory behavior of Hooded Merganser.

(Upper Left) Water-twitching.
(Center Left) Wing-flapping.
(Lower Left) Preening-behind-the-wing.
(Upper Right) "Tacking" toward female.
(Center Right) Postcopulatory "Rotations."
(Lower Right) Postcopulatory "Steaming."

the female solicits copulation while stretched out prone and stationary on the water after both birds have performed display drinking. Before mounting, males of all species perform repeatedly numerous displays which usually include ritualized drinking, stretching, or preening movements. These have been described by Myres (1957, 1959*a*, 1959*b*) for the Bufflehead and the two goldeneyes, and by Dane et al. (1959) and Lind (1960) for the Common Goldeneye. Copulatory behavior in the Common Merganser has been described by Christoleit (1927), and Hollom (1937) and Lebret (1958) have described the corresponding behavior of the Smew. Adams (1947) and Myres (1959*a*) have provided incomplete descriptions of copulation in the Red-breasted Merganser.

I have seen several sequences of copulatory behavior in the Hooded Merganser which may be summarized as follows: The male swims near the female, frequently performing drinking movements with a depressed crest. The female responds by drinking, and each time lifts her head high and forward, with her crest depressed. After several such mutual drinking displays the female assumes the prone posture, with her head held just over the water and her tail flat on the water surface (as in *Bucephala* and the Common Merganser). The male immediately begins to make rather jerky forward and backward head movements which are less exaggerated than, but otherwise almost exactly like, the "Pouting" behavior of Smews (see Hollom, 1937). (In Smews "Pouting" is a courtship rather than a precopulatory display.) The male frequently makes drinking movements and also occasionally performs an Upward-stretch. Suddenly the male begins to dip his bill and part of his head (Fig. 2) rapidly and repeatedly in the water while shaking the bill (as in the *Bucephala* "Water-twitch" display described by Myres, 1959*a*). After several such shakes (6, 7, and 8 have been counted on three different occasions) the male suddenly stops (at this point a male goldeneye would Preen-behind-the-wing once and "Steam" to the female), performs an Upward-stretch with or without Wing-flapping (three flaps counted on one occasion) (Fig. 2), then settles back in the water and immediately Preens-behind-the-wing (Fig. 2) on the side toward the female (exactly as would a goldeneye), and starts swimming in rapid, jerky, Pouting movements toward the female. He does not Steam directly to the female as a goldeneye would, but rather "Tacks" in a zig-zag course toward her (Fig. 2), alternately presenting (seven times in about 5 feet in one instance) the two sides of his crest to her view, the crest being fully raised and presented to the female's full view with each Tacking movement. In five cases I have seen, this sequence of "Water-twitching—Upward-stretch—Preen-behind-the-wing—Tacking-toward-female" was identical every time, but I am not certain how many times Wing-flapping accompanied the Upward-stretch. As soon as the male reaches the female he attempts to mount her, but in only two times observed by me was he successful.

In each case the male remained mounted for ten seconds or more, and performed on each occasion a single Flick-of-the-wings while mounted (as in goldeneyes). After the male successfully completed treading, he slipped off to one side but retained hold of the female's nape for several seconds, during which the two birds "Rotated" slightly (Fig. 2). In neither case was a complete circle rotated, as usually occurs in goldeneyes (see Myres, 1957; Dane et al., 1959). The male then released the female and "Steamed" directly away from her with crest erect (Fig. 2). In one case the male "Plunged" under the water (as often occurs in Buffleheads after copulation) when he was about 5 feet away from the female. In the other case the male swam about 25 feet away from the female in a straight line, exactly as would a male goldeneye except that no lateral head-turning ("Ticking") was observed. The male then began to bathe. The female started bathing as soon as it was released by the male in both instances.

By comparison, the typical *Mergus* precopulatory behavior consists of the male performing repeated drinking movements, together with Upward-stretches (with or without Wing-flapping) and Preening-dorsally, all of which occur independently. I have not observed any Water-twitching in any of the other species of *Mergus*, and have only observed a Preening-behind-the-wing once in the Smew, but it was not linked to any other behavior and may not have actually been a true display. In *Bucephala* (and the Hooded Merganser) however, the Preen-behind-the-wing is completely ritualized, occurring only once and being firmly linked to the preceding Water-twitching (or "Jabbing") and the following Steaming to the female. Male Smews and Common Mergansers lack such a spectacular approach to the female, but rather repeatedly approach and retreat, until they finally are successful in mounting or the female comes out of the prone posture. During treading I have observed that the Smew repeatedly Flicks-the-wings (five times in one case), but this display (which probably has auditory rather than visual function) did not occur in any of the three Common Merganser copulations I have observed. Neither the Smew nor the Common Merganser exhibits postcopulatory Rotations. Male Smews and Common Mergansers swim away from the female after copulation while Turning-the-back-of-the-head to her.

DISCUSSION

Both in courtship and in copulatory behavior most species of *Mergus* and *Bucephala* share certain patterns and differ in others. However, the Hooded Merganser bridges some of these differences in its courtship, and especially in its copulatory behavior. Precopulatory displays of the Hooded Merganser that are typical of *Bucephala* are the repeated Water-twitching and the subsequent Preen-behind-the-wing. In its linkage of these two displays into a rigid sequence just before approaching the female the Hooded Merganser is more similar to the goldeneyes than is the Bufflehead! Typical *Mergus* precopulatory patterns

TABLE 1

COMPARISON OF PRESUMABLY HOMOLOGOUS BEHAVIOR PATTERNS IN *MERGUS* AND *BUCEPHALA*

	Buffle-head	Common Goldeneye	Barrow's Golden-eye	Hooded Merganser	Smew	Red-breasted Merganser	Common Mer-ganser
MALE COURTSHIP							
Upward-stretch	x	x	x	x	x	x	x
Wing-flapping	X	x	x	x	x	x	x
Crest-raising	X	x	x	X	x	x	x
Head-throw	–	X	x	x	x	–	–
Tail-cocking	–	–	–	x	x	x	x
FEMALE COURTSHIP							
Inciting	x[1]	x[2]	x[2]	x[3]	x[3]	x[3]	x
COPULATORY BEHAVIOR							
Drinking by ♂	?	x	x	x	x	x	x
Drinking by ♀	?	x	x	x	x	x	x
Female prone	x	x	x	x	x	x	x
Upward-stretch (♂)	–	–	–	x	x	x	x
Preen-dorsally (♂)	x	–	–	–	x	x	x
Water-twitch (♂)	x	X	X	x	–	–	?
Preen-behind-wing (♂)	–	X	X	X	?	–	–
Steaming to ♀	–	X	X	x[4]	–	–	–
Flick-of-wings (♂)	x	x	x	x	x	?	–
Steaming from ♀	–	x	x	x	–	–	–

x the behavior pattern was observed
X the behavior pattern was exceptionally well developed
– the behavior pattern is apparently absent
[1] "Following" of Myres
[2] "Jiving" of Myres
[3] "Bobbing" of Hollom
[4] "Tacking"

include the Smew-like Pouting and the Upward-stretch and Wing-flapping. Behavioral patterns it shares with both genera include mutual drinking and the female prone posture. In its approach to the female by Tacking, the male Hooded Merganser is intermediate between the direct and rapid Steaming approach of the goldeneyes and the repeated approach-retreat behavior of the typical mergansers. This "compromise behavior" of Tacking immediately calls to mind the "Zig-zag Dance" (Tinbergen, 1951) of the male Three-spined Stickleback (*Gasterosteus aculeatus*) and the pivoting approach of the male to the female in the Zebra Finch (*Poephila guttata*) described by Morris (1954).

The Hooded Merganser also has a single Flick-of-the-wings during treading which occurs in all *Bucephala* species but which I have only otherwise observed in the Smew among the *Mergus* species. Postcopulatory Rotations are also

present, and this behavior is typical of all *Bucephala* species but of neither of the two species of *Mergus* observed by me. Enough evidence is at hand, therefore, to point out the fact that *Bucephala* and *Mergus* share so many complex behavioral patterns in their courtship and copulatory displays that an extremely close evolutionary relationship exists between them (see Table 1). Thus the continued subfamilial separation of these groups that is still adhered to by the AOU Checklist is untenable. Additional evidence for the Hooded Merganser's close relationship to *Bucephala* is provided by the structure of the male's trachea (see Beard, 1951; Johnsgard, 1961). The downy young possess unstreaked cheeks as are typical of *Bucephala* and Smew downy young, rather than the streaked cheeks typical of the other *Mergus* species. The egg-white proteins of the Hooded Merganser exhibit an electrophoretic pattern practically identical to those of the Red-breasted Merganser and *Bucephala* (see Sibley, 1960). The Hooded Merganser is perhaps more closely related to *Bucephala* than is the Smew, which possesses a more *Bucephala*-like bill, which points out the fallacy of regarding bill shape and specialization as a major index to evolutionary relationships.

SUMMARY

The courtship and copulatory behavior patterns of the Hooded Merganser are described, and probable homologies are pointed out with other *Mergus* species and with *Bucephala*. In some of its courtship displays ("Tail-cocking," female "Bobbing") and precopulatory behavior ("Pouting," "Upward-stretch") the Hooded Merganser exhibits typical *Mergus* elements, whereas in others ("Water-twitch" linked to Preen-behind-the-wing, postcopulatory Rotations) it clearly shows affinities with *Bucephala*, and in fact is even more like the goldeneyes in some respects than is the Bufflehead. In still other aspects of display it is intermediate between the typical species of the two genera ("Tacking" toward the female rather than the *Bucephala* "Steaming," or the approach-retreat behavior typical of *Mergus*). The Hooded Merganser thus provides an almost perfect connecting link between *Bucephala* and *Mergus*, and it is concluded that these two groups are no more than generically distinct.

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REPRODUCTIVE BEHAVIOR OF RED-BELLIED WOODPECKERS

LAWRENCE KILHAM

OBSERVATIONS on a hand-raised pair of Red-bellied Woodpeckers (*Centurus carolinus*) which nested in captivity, and observations on wild birds from 1957 to 1960 form the basis of this paper. I did most of my field work in swampy lands near Seneca, Maryland. Additional observations were made at the Archbold Biological Station, Lake Placid, Florida.

METHODS OF COMMUNICATION

Both sexes of Red-bellied Woodpeckers participate in the vocalizations, drummings, and displays outlined below, but males are the more active performers. My interpretations of these forms of expression are based upon the situations attending their performance on repeated occasions.

Vocalizations.—(a) Breeding call. A musical *kwirr* repeated twice or a number of times in succession—delivered in sets of three in tense situations. The call of the female may have a flatter sound, especially when the members of a pair are answering each other. *Kwirr*'s are seldom given during the fall, but may be heard, in almost explosive fashion, on days of suitable weather in early winter.

(b) Territorial call. A *cha-aa-ah*, shaking the whole body and given the year around, possibly because Red-bellied Woodpeckers have individual territories in the fall and winter in addition to their breeding territories at other seasons. The *cha-aa-ah*, like the *kwirr*, may stimulate responses of the same kind from another individual.

(c) Location and mild excitement. An often-repeated *cha*. A Red-bellied Woodpecker may give this note when disturbed by a human observer.

(d) Intense excitement. Expressed by a triple, high-pitched *kew,kew,kew*.

(e) Conflict. Red-bellied Woodpeckers usually make a loud *chee-wuck,chee-wuck,chee-wuck* when engaged in intraspecific conflicts.

(f) Intimate note. A low *grr,grr*, which may be exchanged by the members of a pair from the first days of courtship until the end of the breeding season. This note is not given by lone individuals, in my experience.

(g) Begging calls of juveniles. Young which have recently left the nest beg with a soft *psee-chew*. The first syllable is high-pitched. They clamor for food in succeeding weeks with a *grr-ick,grr-ick*, which is distinct from, but obviously related to, the *grr,grr* of breeding adults.

(h) The vocalizations of nestling Red-bellied Woodpeckers are as varied as among the young of other genera of woodpeckers (Kilham, 1959c). A harsh *chrr* usually accompanies feeding. Further discussion is given below.

FIG. 1. Episode in a conflict observed on 30 January 1960, in which two rival females fought for a male. The intruding female is in the stiff pose expressive of tension as owning female approaches the tree from the left in a floating threat display.

Displays.—(a) The feathers of head and nape are raised when a Red-bellied Woodpecker is excited. This is particularly true of the male whose red feathers, being somewhat long and silky, give him a striking appearance.

(b) Full threat display. Made with wings outstretched at an upward angle of 45 degrees and with tail outspread. The wings may be spread out like a moth's, against the trunk of a tree, in conflicts over holes.

(c) Flight display. A Red-bellied Woodpecker may float through the air toward its landing place with wings held in the position of a full threat display,

when engaged in a conflict with a rival (Fig. 1). *Centurus* appears to have no true courtship flight.

(d) Stiff pose. This display gives the woodpecker a rigid, somewhat bowed appearance (Fig. 1). The bowing results from an elevation of the patch of feathers covering the upper back.

(e) Resting motionless. The members of a pair may rest within inches of each other for minutes at a time, and in silence when close to the time of actual nesting. This form of behavior is common to a number of genera of woodpeckers, and Pynnönen (1939) has aptly described it as "*Regungslos-auf-einestelle-sitzen.*"

Drumming.—Red-bellied Woodpeckers have two types of drumming. The usual type consists of an even burst of about one second's duration. A second type is similar to the first except that it is preceded by a few well-spaced taps—*da-da-drrrrrr.* I have not discovered any different significance in these two forms of drumming, but I have heard them in the aviary as well as in the field and among the closely related Red-headed Woodpeckers (*Melanerpes erythrocephalus*) (Kilham, 1959*a*). Drumming is a far less frequent method of communication with *Centurus* and *Melanerpes* than among *Dendrocopus*, *Dryocopus*, and *Colaptes* (Kilham, 1959*b*, *c*, and 1960). The drumming of Red-bellied Woodpeckers appears to serve as an assertion of territorial dominance. It is sometimes associated with conflicts.

Tapping.—Delivered at a regular rate of 2–3 taps per second and with 4–20 taps in each burst. The members of a pair may tap together in mutual tapping. Tapping is closely associated with nest-site selection and maintenance of the pair bond, not only in *Centurus* (Kilham, 1958*a*), but also among other woodpecker genera (Kilham, 1959*a*, *b*, *c*).

EARLY BREEDING BEHAVIOR

Continuing studies of Red-bellied Woodpeckers have enabled me to complete, in some degree, an account of their early breeding behavior presented in a previous report (Kilham, 1958*a*). The additional aspects of behavior are illustrated by the histories of Pairs A and B.

Beginning of breeding season.—Observations on Pair A indicate that male Red-bellied Woodpeckers may stay on their breeding territories the year around and that females, in some instances, may compete for them early in the year.

(a) Territory of Male A.—I observed Male A excavating a nest hole in the dead limb of an elm on 22 February 1959. A subsequent wind storm broke the limb where the excavation had weakened it, but in the fall of the same year I watched Male A excavate a new hole just below the site of the old one. I did not see him in association with any other Red-bellied Woodpecker at this time. On 20 December I saw Male A fly to his excavation and start to tap as a female, making *grr,grr* notes as she flew, alit on the other side of the cavity and joined in mutual tapping. It was of interest that the woodpeckers

were using the same hole for actual nesting by 30 April 1960, when I observed them in full copulation on an adjacent limb.

(b) Competition of two females for a male.—On 30 January and again on 6 February 1960, I witnessed prolonged conflicts between two females appearing to be rivals for Male A and the hole he had excavated. Events were similar on both mornings. The females had two centers of their continually renewed conflicts, one being Male A, who called *kwirr, kwirr* from various tree tops but appeared to be indifferent to the actual fighting, and the other, the nest excavation in the elm. The intruding female might fly to either place. What I judged to be Female A would follow closely, hitch up toward her rival, then fly out in any direction in a long circular pursuit. All pursuits appeared to be restricted within the usual limits of the male's territory. The females were silent most of the time, but one might call *chee-wuck, chee-wuck*, and in two instances they clashed in bodily contact. Figure 1 illustrates an episode in the conflict. As Female A flew to the tree in which her rival and the male were resting, she floated the last 10 feet of the way with wings outstretched in a threat display. There were few respites in the conflicts. I watched one going on continuously for two and one-half hours on 6 February. I had observed a similar situation among Yellow-shafted Flickers (*Colaptes auratus*) in which two females contended for a male in mid-winter (Kilham, 1959*b*).

Events leading to actual nesting.—Pair B was well situated for observation because the nest hole was only 20 feet above the ground and remained free of molestation by Starlings (*Sturnus vulgaris*). The activities of the two woodpeckers offered many points of comparison with those of my hand-raised pair, whose breeding behavior is described later.

(a) Mutual tapping and nest-site selection.—On 9 March 1958, Male B called *kwirr* while moving about on the dead stub of a living ash. He pecked at random, as if percussing the underlying wood. There was no sign of an excavation. When I was standing directly below him a little later, he tapped four bursts of about 15 taps each, whereupon his mate flew in and joined in several seconds of mutual tapping. A fresh, shallow excavation appeared on the stub within the next two weeks. Nearly two and one-half months later, on 30 May, I removed two well-feathered young from a nest located at the spot where Pair B had had mutual tapping on 9 March.

(b) Intercommunication during the period of excavation.—The male did most of the excavating. In pauses between bouts of work he often called *kwirr, kwirr* and his mate, who was usually within a range of 150 yards, would answer *cha, cha* or a flat-sounding *kwirr*. Mutual tapping took place periodically. On 29 March, for example, the male was excavating with his body half way in the hole when he dropped down to one side and began to tap. His mate came immediately. The pair then joined in mutual tapping before she flew away. It is probable that the male had been stimulated to tap by seeing that his mate had come close by. On the following day both woodpeckers were away from their excavation when they suddenly flew to it simultaneously and joined in a bout of mutual tapping. Red-headed Woodpeckers may communicate in an analagous fashion during the period of excavation (Kilham, 1959*a*).

(c) Lack of agreement in mated pair.—The nest excavation progressed slowly. It appeared in a variety of ways that the female Red-bellied Woodpecker had a breeding urge less developed than that of her mate in the unusually cold spring of 1958. First, she didn't participate in the work of excavating and second, on 5 April, I witnessed two occasions following bouts of mutual tapping, when both members of the pair held their

bodies in a stiff pose expressive of tension, for one can observe the same pose in conflicts between rival males.

(d) The lone male.—The female sometimes left the nesting territory on a long flight over the tree tops to visit, I suspected, a cornfield in the uplands. Her mate, failing to get any response from her at these times made what appeared to human ears to be "frantic" vocalizations. On 12 April, for example, he clung to the entrance of his excavation and called *kwirr, kwirr, kwirr* every three to five seconds for 40 minutes. I then saw a Red-bellied Woodpecker flying in over the leafless tree tops. The male became silent immediately. A few moments later the pair was together at the excavation. I witnessed a similar episode on 20 April in which the male called *kwirr* in sets of three as before, persisted for 15 minutes, then became silent when his mate returned.

(e) Behavior of pair at time of egg-laying.—Egg-laying probably began within a few days of 20 April. This calculation was made not only by reckoning backward from 30 May when I took two advanced fledglings from the nest but also from two concurrent forms of behavior which indicated that the female had finally accepted the nest hole. The behavior patterns were as follows: (1) Both birds remained silent and motionless for eight minutes on 20 April, the male resting inside the nest and his mate on the outside. (2) The female then entered the hole. I then heard *grr, grr* notes. The male was the first to wriggle out the entrance and another silent, motionless period of five minutes followed before the pair flew away.

CONFLICTS OVER NEST HOLES AND TERRITORY

Red-bellied Woodpeckers are territorial during the nesting season. Evidence for this territoriality is difficult to obtain in well-wooded country but two of the conflicts described below took place along a common boundary more or less equidistant between the excavations of two nesting pairs. Three other conflicts occurred close to nest holes. Features characteristic of these conflicts were that when only two individuals were engaged, they were of the same sex and fought in silence, whereas whenever three or four birds representing two pairs were in conflict, a lively combination of vocalizations, drummings, and displays usually took place. The situations observed were as follows:

Territorial conflicts between two females.—On 3 April 1958, Female A flew low over 50 yards of swamp directly at the female of adjacent Pair B. A silent conflict now took place close to the ground. One female would fly at the other, who would dodge around a tree trunk, but on one occasion the two females rose 3 feet into the air, grappling together as they flew. Both withdrew after several minutes. Their battleground was 90 yards from the excavation of Pair A and 70 yards from that of Pair B. The two females had another conflict at the same place 10 days later, so that there was reason to believe that the area represented a boundary separating the territories of the two pairs. Selander and Giller (1959) found a well-defined boundary separating a pair of *Centurus carolinus* from one of *C. aurifrons* in Texas.

Conflict between two rival pairs.—On 12 April 1958, I witnessed a conflict between two pairs of Red-bellied Woodpeckers which went on for one and one-half hours (and probably longer). Pair C owned the disputed nest hole located 60 feet up in a dead elm. A peculiarity of this conflict was that I could identify the attacking male by his aberrant call, a loud *quee-ark*. This abnormality is discussed later. The pattern of the struggle on the morning of 12 April was as follows: The owning male (OM) would bow

in and out of his nest hole, his red crest bristling straight backward while the intruding male (IM) approached from a distance calling *quee-ark*. OM would fly at IM. The intruder would then dodge under a limb and raise his wings in a full threat display. As IM was driven farther away he might suddenly dart toward the nest hole. The conflict would then renew itself. Although all four birds of both pairs were occasionally close together in this conflict, it was clear that the main conflict was between the two males. The clashes between the females were mild in intensity. One female, when pursued by the other, might remain away for 10 minutes at a time. During some intervals the two males had prolonged exchanges of their vocalizations, *quee-ark* and *kwirr*. One often drummed in between his calls. *Chee-wuck*, *cha-aa-ah*, and *grr* were other vocalizations heard in this conflict involving both sexes. Pair C retained its nest hole and I watched them feeding young in June.

Intruding male and a mated pair.—On 10 May 1958, I observed coition in Pair D. An IM came close to the nest hole on the same morning and I immediately heard a mixture of *grr* notes and *chee-wuck*'s as the pair faced their visitor. Both males had their crests raised. IM raised his wings in a threat display on two occasions before being driven away by OM, whose mate did not participate in the conflict.

Conflict between two males.—Male A was excavating on 29 March when an intruding male appeared 25 feet away and called *kwirr* a number of times. The two males rested motionless, as if frozen. Male A then flew at IM who averted contact by swinging under a limb. There was no display and no noise. After several such episodes the intruder flew away and Male A backed down to his excavation, holding a bent, stiff pose as he did so.

INCUBATION PERIOD

Red-bellied Woodpeckers become relatively quiet at the onset of egg-laying and the activities of Pair F may serve to illustrate events of the ensuing period. The entrance of Nest F was 20 feet up in the dead top of a living willow. On 18 May 1957, I cut away the wood and wired an aluminum back onto the rear of the nest cavity. There were four eggs at this time. The woodpeckers were incubating a week later, but on 30 May I found the aluminum covered with the muddy paw marks of a raccoon (*Procyon lotor*). The nest contained two eggs and two newly hatched young, all dead. One egg and one nestling were mutilated, as if punctured by the bill of some bird. Observations on the parent birds while they were incubating in the previous period were as follows:

Both birds appeared to be restless when taking turns within their nest on the week-end of 11 May. Egg-laying was presumably in progress at this time. The female would often put her head out, then withdraw it half-way. The male was even more restless, for when guarding the nest he might somersault out of the entrance, call *quee-ark* when he had righted himself, then return inside. He also called in a wide radius about the nest tree at times when the female was in the nest. His loud, aberrant *quee-ark* was easy to distinguish from the *kwirr* of neighboring males. I observed similar restlessness on 18 and 23 May while watching from a thicket 70 yards away. There was no sign of activity at the nest on 26 May. After watching for 20 minutes, I approached and stood below. At this moment the female flew up close to the entrance and I heard the male start tapping on the inside at her approach. She entered the nest after he had flown out. Had I been watching from any distance I would not have heard the tapping response of the

male to his mate's arrival. I was to hear this type of tapping many times later on, with my captive pair.

THE NESTLING STAGE

I observed 10 pairs of Red-bellied Woodpeckers while they were feeding their nestlings. The following is a generalized picture of their activities.

Feeding of young.—When the young were recently hatched, one parent stayed with them until the other arrived with food to take its place. Parents usually had many insects protruding from their bills on arrival, and this prey, while small in size in the early nestling period, was larger later on when big beetles, long-legged, gauzy-winged insects, and even butterflies were brought in. The woodpeckers captured most of their prey on tree trunks. On 30 May 1958, for example, I watched the female of Pair A alight on one tree after another, landing low on each trunk and then ascending rapidly. She managed to catch insects even when her bill was already loaded. She then flew to a broken branch where she appeared to store some of her prey, for she returned to the same spot after flying away to feed her young. Parent birds occasionally brought in fruits, carrying two or three nearly one-quarter inch in diameter in their bills at one time. Some of these fruits may have been wild cherries. Parents disappeared inside nest cavities in order to feed the young when they were small. At later times the tails of the old birds projected from entrances as they fed their offspring, and at a still later period the young climbed to the entrance where the parents fed them from outside. Feeding visits varied in frequency with the weather and the time of day. They were apt to be most frequent early on a warm day, as on 18 May 1957, when the two birds of Pair E fed their young 10 times in the 26 minutes after 7 AM. The female made eight of these visits. On 7 June 1958, the male and female of Pair D made two visits each within an eight-minute period.

Greeting ceremonies.—Red-bellied Woodpeckers usually fly directly to their nest holes when carrying food. On 11 May 1957, Male E alit on the bark below the hole and rested quietly for a few seconds. His mate then appeared from within the entrance and made a slight chatter as she flew off. Hungry young ones greet an entering parent with harsh *chrr*'s. These *chrr* notes are not easy to hear and I usually heard them only when standing close to the nest. Adult Red-bellied Woodpeckers were relatively silent when away from their nests gathering food for their young. The vocalizations they made included *kwirr*, *cha*, *cha-aa-ah*, and *kew*, *kew*, *kew*; most of these expressing some degree of excitement at such times, for example, as when I stood near the nest tree while a parent bird waited nearby with a bill-full of insects. Males might drum under these circumstances. In the course of 41 feeding visits observed for Pair E, the male started drumming on two occasions when I came close and, from my usual observation post at a greater distance, I witnessed the chatter greeting ceremony

of the parents in four of the 41 visits. On most visits the two birds did not encounter each other. I have not heard tapping during the nestling period.

Nest sanitation.—Methods of nest sanitation were not obvious among the Red-bellied Woodpeckers. Parent birds were often making motions with their tongues as they emerged after feeding and I came to believe that they had just swallowed the excreta of their young. I never saw a recognizable fecal sac in their bills at any time. Of six Red-bellied Woodpeckers taken as nestlings, none produced fecal sacs. But two young Flickers, hand-raised under similar circumstances, produced well-formed sacs. Two of the nest cavities, from which I removed well-feathered young, were remarkably clean. The third nest cavity had one-half inch of damp detritus on the bottom, and three nestlings with early pin feathers.

Observations on nestlings.—Woodpecker nests are usually too inaccessible for close study but I was able to observe some features of nestling behavior by removing the young. Three nestlings were taken from a nest on 23 May 1959. Their eyes were beginning to open and they had pin feathers up to one-quarter inch in length. It was apparent at the time of removal, as well as in ensuing weeks, that the three were of different ages in regard to feather growth and behavioral development. The tips of upper mandibles and the protuberant knobs at the corners of the bills of the young were sharply white in color. Young Flickers, among other woodpeckers, have a similar white point at the position of the egg tooth. One may speculate that parent birds, when darkening nest entrances on arrival with food, may be guided to the mouths of their offspring by these white points which disappear only as nestlings become well feathered. The knobs at the corners of the bill are sensitive areas. We found that if we brushed these knobs with a toothpick carrying a morsel of food, the bills of the nestlings would open widely as their necks stretched upward. This begging response could be induced by passing a hand between the birds and a source of light, if the nestlings were on a lighted surface. It seemed likely that the sudden shading was the effective stimulus, for jarring or movement alone had no effect. Results were different in the dark. The nestlings were kept in a dark cabinet, and any scratching on the door or miscellaneous jarring, such as the closing of a nearby refrigerator, was sufficient to elicit a gush of begging cries. These cries were harsh and as steady as if one had turned on a faucet. Once the young had been fed, however, they sank back and made soft, musical *wee-urp*'s which had a contented sound to human ears. The cabinet was equally dark at all times. At night, however, the nestlings would settle down to a low *purp, purp, purp* continuing even after midnight when they were apparently asleep. Nestling Pileated Woodpeckers (*Dryocopus pileatus*) exhibited similar patterns of vocalization (Kilham, 1959*c*).

Young Red-bellied Woodpeckers, when well feathered, developed an urge to

scurry away and cower in the darkest place available after being fed and, a little later on when they might have been leaving their nest under natural circumstances, they became wild and pugnacious, as evidenced by attacks on each other as well as on our fingers. This aggressiveness appears to be a specific characteristic of Red-bellied Woodpeckers. I have not encountered it among the young of *Dendrocopus*, *Dryocopus*, *Colaptes*, and *Sphyrapicus* raised under similar circumstances.

Time of nest leaving.—I watched two Red-bellied Woodpeckers feeding their young over four week ends from May into June 1958. On 22 June the female fed the last young one in the nest at 7:15 AM. There were no more feeding visits over the next half hour in which the young one perched well out of the entrance, giving a frequent harsh chatter, not only in response to the *kwirr*'s of its parents who were farther down in Creek Wood, but also to the vocalizations of other neighboring Red-bellied Woodpeckers.

PARENTS AND YOUNG AFTER NEST LEAVING

Full foliage in the woods and the comparative quietness of the Red-bellied Woodpeckers after their young had left the nest made it difficult to follow them in summer months. Creek Wood, however, was an open area favorable for observation. Young were raised there in two succeeding years and as juveniles, in each year, they followed their parents about for nearly two and one-half months. These young ones were relatively inactive much of the time, resting while their parents moved up tree trunks or flew into clusters of leaves to catch insects. Adults dismembered large insects before feeding them to their offspring. The begging cries of the juvenile were of two types and were well illustrated by a hand-raised female who would have left her nest at the end of May under natural circumstances. She often fed from my hand. In June her begging note was a high-pitched *psee* or *psee-chew*, but by July her cry under similar circumstances became *grr-ick*. Both of these vocalizations were of help in locating the family groups in Creek Wood. During the summer of 1958 the wood was occupied by an adult male and a juvenile which followed its parent closely at all times. The adult female was attended by the second young one of the family in a similar fashion. These two, however, rarely returned to Creek Wood where the nest had been located. I had reason to suspect that the male had become hostile toward his former mate. On 13 September, for example, he was moving about with his attendant offspring in a peaceful fashion when he suddenly flew to the edge of the wood where I saw the female and her young one. The male had his crest raised, and there was an outburst of vocalizations which included *chee-wuck,chee-wuck*, *grr-grr*, and *kew,kew,kew*. The female held a stiff pose. After a minute of this confused conflict she flew away followed by her young one. During the same summer I observed another family of Red-bellied Woodpeckers by the canal which appeared to be divided in a similar fashion.

In the summer of 1957, the family which occupied Creek Wood consisted of three offspring, and these juveniles had noisy conflicts among themselves. On 20 July I heard two of them calling *chee-wuck* before grappling together in mid-air. A week later all three juveniles were together on a dead tree. One would perch on the top and the others would fly to replace it with noisy *kwirr*'s and *chee-wuck*'s. This conflict behavior could be interpreted as play.

SECOND NESTINGS

I have had no evidence that Red-bellied Woodpeckers raise more than one brood a year in the vicinity of Seneca, Maryland. Thick foliage, however, makes complete observation difficult in the late spring and summer. The situation appears to be different farther south. Hauser (1959, and personal communication) has had good evidence that a marked male raised a second brood in South Carolina in two successive years, and, while in Florida in mid-June 1960, I observed a pair of Red-bellied Woodpeckers finishing the excavation of a nest hole. The two birds had full copulation on 14 June. On the same day and 300 yards away I watched a juvenile bird for several hours. It appeared to be independent of any parents.

BREEDING BEHAVIOR IN CAPTIVITY

A pair of Red-bellied Woodpeckers, raised in a preceding year, nested successfully in the spring and again in the summer of 1960 in my aviary—a modified indoor garage. The development of their breeding behavior was as follows:

Early breeding behavior.—(a) Fragmentary interest in the fall.—On 22 October 1959, the female tapped vigorously and called *grr,grr* when the male alighted near her. I had witnessed an almost identical episode with a wild pair five days previously, but there was no sustained development of breeding behavior, either in the field or in the aviary, until the beginning of winter.

(b) Female flies to male at dawn.—The female was flying to the male's roost hole at dawn by mid-December and she continued this habit through the next July, except for periods when larger young were in the nest. This visit was in the nature of a greeting. She would tap on the outside of the box and, by 3 January, he was joining her by tapping on the inside at the same time. The male was slow about emerging from his roost hole. He would rest inside for 20 to 30 minutes after the greeting ceremony. I have described this type of behavior at dawn, as observed among wild Red-bellied Woodpeckers, in a separate report (Kilham, 1958*a*). The roosting place of the captive male later became the nest box and his mate developed a constant habit of resting in it for an hour or so every late afternoon.

(c) First breeding calls.—We began to hear *kwirr*'s coming from the aviary on 28 December 1959, and for some weeks the woodpeckers made most of these vocalizations while light was still dim at dawn. We had never heard them give

kwirr's in previous months. There were variations in the numbers of the vocalizations given from day to day; on some mornings the woodpeckers were noisy for several hours but on others they were quite silent. On 3 March, for example, a morning of heavy snowfall, our Red-bellied Woodpeckers gave *kwirr*'s in sets of three every four to five minutes after 5:45 AM, although they did not leave their roosting places until nearly 6 AM. On the following morning we heard only one *kwirr* prior to 8 AM. I have described an outburst of breeding behavior among the Red-bellied Woodpeckers of Seneca Swamp on a morning of freshly fallen snow (Kilham, 1958*a*). Whatever meteorological conditions affect avian activity, as judged by the volume of song and other vocalizations, they appeared to influence our indoor birds. Cardinals (*Richmondena cardinalis*), for example, were doing their greatest amount of singing in the yard on mornings when our captive Red-bellied Woodpeckers were calling an unusual number of *kwirr*'s in the aviary. Such correlation was fairly regular during the spring.

Increasing intimacy.—The new forms of behavior outlined below indicated that a closer pair bond developed between the two woodpeckers in the last weeks of March.

(a) Greater association with the nest box.—The male entered the nest box on 24 March when his mate was already on the nest and the pair remained out of sight for a few minutes before she emerged. This togetherness within the nest became of frequent occurrence in succeeding weeks. The male spent increasing periods of time resting on the box during the day and, if his mate came close, he would start to tap or make the *grr,grr* note. The pair engaged in mutual tapping on the box at other times. I observed a new behavior on 3 April when the female, who had been resting on the inside of the nest hole, dropped down and tapped out of sight when her mate alighted on the stub above. Later on the same morning both birds rested, silent and motionless, he within and she on the outside of the cavity. Such episodes became more frequent.

(b) Head-swinging and bill-touching.—It was apparent by early April that the two woodpeckers were meeting on the top of a tall stub, both birds swinging their heads somewhat as the male, with crest raised and calling *grr,grr*, kept trying to touch the female's bill with his own. This performance was of interest in retrospect, for it became the prelude to copulatory behavior on the same stub. Attempts at bill-touching may represent courtship feeding. On 6 April, when the male had carried a small chip of wood to the top of the stub, his mate ran out her tongue to explore it, then seized it and flew off. I observed a closer simulation of parent-young feeding, however, on 24 April. The male was looking out from the nest entrance when the female made repeated attempts to seize his bill within her own. This event occurred five days before the first egg was laid.

COPULATORY BEHAVIOR

I observed full copulation on 12 occasions between 28 April and 6 May. A first egg was laid on 29 April. Inspection of the nest appeared to upset the pair and I did little further inspecting until 8 May, when there were three eggs. The phases of copulatory behavior were as follows:

(a) Initial signs of interest.—The male fluttered on the female's back on 11 April and by 24 April this pseudo-coition was being preceded by reverse mounting on the part of the female.

(b) The full copulations which began on 28 April frequently took place when I turned on the lights in the aviary at about 6:20 AM, but they might occur at almost any time later in the day. The pair nearly always copulated in the same place. This was the top of the tall stub where the two had done their bill-touching in previous weeks.

(c) Preliminaries.—The female flew to the male as if on signal, just preceding most of the copulations. Indications of the male's readiness might consist of his giving a single *kwirr* or simply arriving at the top of the stub. There were no set preliminaries so far as I could determine.

(d) Reverse mounting.—When the female flew to the male, he was usually in a low crouch as if inviting her by the time she arrived (Fig. 2-Left). She would immediately flutter on his back in reverse mounting (Fig. 2-Center). A medley of *grr*'s at this time might alert me to what was going on, even if I were in another room.

(e) Full copulation.—The male mounted the female directly after the reverse mounting. She assumed no special pose. He sometimes waved his wings during the whole process of copulation but usually only briefly and at the start. Once

FIG. 2. Copulatory behavior of Red-bellied Woodpeckers. (Left) Male assumes crouching position as female flies to him. (Center) Female flutters on back of male in reverse mounting. (Right) Final position of full cloacal contact, after male had mounted female and fallen to left.

established on her back, he always fell down to the left. His final position was on his back with his body at right angles to hers so that the tails of the two birds were overlapped in cloacal contact (Fig. 2-Right). Southern (1960) has given a description of similar copulatory behavior among Red-headed Woodpeckers.

(f) Female's drive the more persistent.—The female's sexual drive apparently persisted longer than that of her mate as indicated by the fact that the pair might return to the stub within 10 minutes of full copulation, but only reverse mounting would take place. In addition, reverse mountings continued from 7 May through 11 May, although copulations stopped on 6 May.

INCUBATION AND CARE OF YOUNG

(a) Greeting ceremonies.—The female continued to greet her mate at dawn. He would start tapping at the bottom of the cavity when she appeared but there was no mutual tapping or tapping on the outside of the box during the incubation period. The female might respond to the male by tapping at the bottom of the excavation at other times of day. She would then slip out and leave the nest to him. He did the greatest part of the incubating by day as well as remaining in the nest at night. The pair became increasingly quiet as incubation progressed. On 12 May the female came below the entrance and gave a low *grr-ick, grr-ick*, the first time I had heard her give this vocalization since she had been a juvenile.

(b) Hatching.—Events were similar on 18 May and on 9 July, the dates on which the young of the first and second broods, respectively, began to hatch. The female exhibited a sudden change of behavior. She greeted me in the morning by alighting on my head and pounding my skull (which I interpreted as meaning that she needed some new kind of food and quickly). I brought meal-worms which she prepared with much careful crushing and nibbling. She then carried one to the nest and I could hear *chrr,chrr,chrr* notes as the first hatchling was fed. Hatching took place over the course of two days in the case of both broods.

(c) Guarding, brooding, and feeding the young.—The male remained so close to the young during the first week after hatching that we rarely saw him. He would not move, even when I put a light and mirror into the nest. The female continued to be bold and demanding, taking great numbers of meal-worms from our fingers, which he would not do. This led to a peculiar situation. She would take meal-worms to the nest and either enter in spite of his being there or, more frequently, she would give the food to him at the entrance and he would relay it to the young. This relay system took place in both nestings. It was the reverse of what I have described for another species of hole-nesting bird, the Casqued Hornbill (*Bycanistes subcylindricus*), in which the male always feeds the female at the nest entrance (Kilham, 1956).

(d) Nest sanitation and continued excavation.—The nest remained fresh and

FIG. 3 FIG. 4

FIG. 3. Young Red-bellied Woodpecker on eighth day after hatching in indoor aviary. The position is natural.

FIG. 4. A hand-raised female Red-bellied Woodpecker in threat display, faces a rival female in an adjacent cage.

clean throughout the nesting period and I believe that the parents swallowed the excrements of the young, for they never carried anything away from the nest which we could perceive. It is possible that the male's occasional bouts of excavating provided fresh litter on which the young could rest (Fig. 3).

(e) Young leave the nest.—The three young ones left their nest between the morning and evening of 13 June, 26 days after the onset of hatching. They appeared to leave without any special encouragement from their parents. All three continued to re-enter the nest hole for the next few days. They often made a prolonged, harsh chatter when about in the aviary. These young remained as wild as if they had hatched under field conditions and, since they were unsatisfactory for observation, I had them banded and liberated within three weeks, by which time their parents were already incubating a second clutch of eggs.

(f) Second nesting.—I placed a new nest box in the aviary on 17 June when I noticed a renewal of copulatory behavior. The male did a considerable amount of excavating. I observed full copulation on 25 June, but it had probably taken place before this time, for there were two eggs in the nest on the following day. This was 13 days after the young had left the old nest. The final clutch of four eggs hatched on 9 and 10 July. Due to the lack of a steady supply of meal-worms,

three of the young died within a few days. The fourth one remained in good condition until eight days of age, when I cut the nest box in order to photograph it within the nest (Fig. 3). Both parents were suspicious of the nest after I had wired it together. This led to a neglect of the one remaining young, which died.

DRUMMING

The Red-bellied Woodpeckers did little drumming in the course of their breeding activities. Neither of two captive females, one mated and the other unmated, has ever drummed so far as I know. The male of the pair did his first drumming on 11 April, when he was showing his initial interest in copulation, but there were no indications that the drumming had any special relation to either courtship or pair formation. It appeared to serve as a demonstration against rivals. Most of the male's drumming was done at the edge of a window looking out onto a yard where a wild male called *kwirr* many times a day. I was able to precipitate drumming in another way. On 29 May 1960, when the Red-bellied Woodpeckers had been feeding their young for 10 days, I introduced a female Pileated Woodpecker into an adjacent cage. The reaction was immediate. The male Red-bellied made continuous efforts to attack the Pileated Woodpecker through the wire, calling *chee-wuck,chee-wuck* as he did so and making full threat displays. The two birds jabbed at each other, back and forth. When the larger woodpecker finally lost interest and went about her usual activities, the male Red-bellied drummed for over an hour, completely neglecting his young and keeping as close to his adversary as the wire would permit. The female Red-bellied Woodpecker's reaction to a rival was somewhat different. She paid no attention to the Pileated in the above episode and when faced by a female of her own species in the adjacent cage, the two birds engaged in brief bouts of jabbing and threat displays (Fig. 4). These encounters were always silent affairs, unaccompanied by drumming. Evidence is given below that the male Red-bellied probably regarded the Pileated Woodpecker as being a specific rival.

UNUSUAL BEHAVIOR

Unusual behavior, from unusual circumstances, may influence one's interpretation of more usual activities and this is true of the three examples outlined below, which involved wild as well as captive Red-bellied Woodpeckers.

Relations of captive birds to Pileated Woodpecker.—The hand-raised Red-bellied Woodpeckers have lived in association with flickers, sapsuckers (*Sphyrapicus varius*), and Hairy (*Dendrocopus villosus*) and Downy (*D. pubescens*) Woodpeckers but have not responded to these cage-associates in any special way. They have, on the other hand, reacted in a definite fashion to a female Pileated Woodpecker. Thus it was apparent over many months that both the male and the female Red-bellied Woodpeckers regarded the larger bird as a near approach

to being a male of their own species. My guess is that the crest of the Pileated served as an exaggerated releasing mechanism. The fact that this bird was the only one in the aviary to have a crest of the same red color and silky texture as that of a male Red-bellied Woodpecker offered some support for this hypothesis. I have described phenomena of a similar nature elsewhere (Kilham, 1959*c*). In this latter situation it was the lone female Pileated Woodpecker which exhibited a vigorous and constant reaction to a female Yellow-bellied Sapsucker. The reactions of the captive male and female Red-bellied Woodpeckers to their larger associate may be outlined as follows:

(a) Reactions of female.—One of our two hand-raised female Red-bellied Woodpeckers has never had a mate. This female began to show an interest in the Pileated Woodpecker when she first assumed adult plumage in the fall of 1958. The attraction has persisted over the course of two breeding seasons, as indicated by the following activities: flying to the Pileated's roost box and tapping at dawn; following the Pileated about and tapping wherever it might be pecking and, in addition, calling *grr, grr* when the larger bird came close. These forms of behavior were similar and comparable to those of the mated female described in a separate section above.

(b) Reactions of the male to the Pileated Woodpecker.—The aggressiveness of the male Red-bellied Woodpecker toward the Pileated, also described above, has persisted for one and one-half years, making it impossible to keep the two birds in the same cage. Whenever I have done so, the Pileated Woodpecker has hidden in its roost box all day. The male has kept it there by perching within a few feet of the entrance, constantly bowing its head and making the vocalizations *cha* or *cha-aa-ah*.

Aberrant breeding call.—The following situation, in which a wild male Red-bellied Woodpecker in Seneca Swamp gave the breeding call of a Red-headed Woodpecker in complete exclusion of that of its own species, may have reflected the relation which appears to exist between *Centurus* and *Melanerpes* (Kilham, 1959*a*). Red-headed Woodpeckers over-winter in the swamp in some years. In 1956–57 they began to give their breeding call, a *quee-ark*, before migrating to breed elsewhere (Kilham, 1958*b*) and on 2 May, after the last of them had left the main swamp, I observed a male Red-bellied Woodpecker calling the same *quee-ark*. The vocalization was in sharp contrast to the *kwirr*'s of neighboring males. I located the nest hole of the *quee-ark*-male three days later and I was able to follow his activities and those of his mate for the next three weeks. The male never called *kwirr* during this or subsequent periods of observation. His other vocalizations were typical of those of his own species. I did not hear him again until 15 December 1957, when the Red-bellied Woodpeckers of Seneca Swamp experienced a short ourburst of breeding behavior. The *quee-ark*-male was still in the same area in which he had nested in May. My next encounter with this

individual was 500 yards away when, on 12 May 1958, he and his mate had a prolonged conflict over a nest hole which belonged to the latter birds. I have never heard a male Red-bellied Woodpecker call *quee-ark* since that time.

Attacks of lone female on nesting pairs.—The following incidents parallel those which I have described among breeding Casqued Hornbills (Kilham, 1956). Whether the females of both species of hole-nesting birds were prompted to attack the nests of others of their own kind due to the lack of a mate or to the loss of one, I could not determine. The observations on the Red-bellied Woodpecker were as follows:

I was standing below the nest hole of Pair E on 4 May 1957, when an intruding female (IF) flew to the entrance 15 feet above me. Female E was on the inside, presumably incubating her eggs. The two females jabbed at each other vigorously and small feathers floated down. IF had flown in to renew these attacks four times within a minute when Male E arrived and pecked savagely at the rear of the intruder while his mate engaged her head-on within the entrance. The intruder then took flight with Male E in pursuit. By the next morning IF had transferred her attacks to Pair F. This pair of Red-bellied Woodpeckers had a nest 100 yards from that of Pair E and I watched the conflicts which centered on it from 10:15 until 11:40 AM. They followed a rather constant pattern. Male F would chase the intruder through the surrounding woods to the accompaniment of *cha*'s and *chee-wuck*'s, then return to his nest hole and pop inside. IF would return immediately. Male F would come out to drive her away and another pursuit would follow. Female E took almost no part in the conflicts, even when all three woodpeckers were together in the same tree. It is possible that the IF was attracted by the noise of young within this second nest for at one time she arrived with food in her bill, only to be driven away as abruptly as before.

SUMMARY

Vocalizations, drummings, and displays of Red-bellied Woodpeckers have been studied in relation to their breeding behavior. Observations regarding this behavior may be summarized as follows:

(1) The male takes the initiative in location of a nest hole and seeks the approval of his mate in a ceremony of mutual tapping. He spends more time by the nest hole than she does. The members of a pair, however, remain in contact with each other by an exchange of vocalizations within their nesting territory. If a female leaves her nesting territory, her mate may call incessantly until she returns.

(2) Red-bellied Woodpeckers are pugnacious birds. Described are various types of conflicts centering on issues such as the possession of a nest hole, or on the rivalry for a mate and territorial boundaries.

(3) Acceptance of a nest hole by the female may be delayed until seasonal conditions are favorable. Full acceptance by the female is indicated by the two members of the pair completing the excavation, entering the nest hole together and resting motionless in each other's proximity either within or on the outside of the nest cavity. Copulatory behavior increases in frequency at this time.

(4) The phases of copulatory behavior usually consist in the male assuming a crouching pose as the female flies to him and flutters on his back in reverse mounting. The male then mounts her in full copulation, gradually falling to the left.

(5) Paired Red-bellied Woodpeckers become quiet at the time of egg-laying and incu-

bation. The newly hatched young are brooded by one parent or the other for much of their first week and, as they grow older, they are fed insects of increasing size.

(6) Fecal sacs have not been seen among either wild or captive birds. Parent Red-bellied Woodpeckers apparently keep their nests clean by swallowing the excreta of their young.

(7) The reactions of nestlings were studied by means of hand-raised individuals. Their begging and begging cries were stimulated by sudden shading if they were on a lighted area or by jarring if they were in the dark. The range of their vocalizations was considerable.

(8) A pair of hand-raised Red-bellied Woodpeckers bred in their first year in an indoor aviary. They reared three young in their first nesting and a second nesting was equally successful to the point of hatching but had to be interrupted due to extraneous circumstances.

(9) Copulation, including the preliminary reverse mounting by the female, is described in detail.

(10) Juveniles may leave their parents within a few weeks in the event of a second nesting. Otherwise, they may remain with them for several months until family groups break up in September.

(11) Three examples of unusual behavior are described. One concerned a male Red-bellied Woodpecker which gave the breeding call of a Red-headed Woodpecker to the exclusion of its own; and another, a lone female which attacked the nest holes of two mated pairs. A third situation concerned the peculiar and persistent reactions of male and female hand-raised Red-bellied Woodpeckers to a Pileated Woodpecker kept in the same aviary.

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NESTING SUCCESS CALCULATED FROM EXPOSURE

HAROLD MAYFIELD

IN reporting the nesting success of birds, it is customary to give the numbers of nests and eggs in the sample, the number of eggs that hatch, the number of young birds fledged, and various percentages derived from these.

In my analysis of the nesting success of the Kirtland's Warbler (*Dendroica kirtlandii*) I had shortcomings and subtleties in my data that could not be treated satisfactorily by the customary methods. Most serious of these problems was the fact that many of the nests in my sample had not been found until after incubation had begun. That others did not mention such difficulties was not reassuring but rather aroused the suspicion that some of their findings might not be so exact as the cold finality of their figures seemed to imply.

Consequently, I proposed a new way of analyzing data of this kind (Mayfield, 1960. The Kirtland's Warbler. Cranbrook Inst. of Sci., Bloomfield Hills, pp. 182–209). There, however, the method was incidental to the results, and it was complicated at every turn by the effect of Brown-headed Cowbirds (*Molothrus ater*) in the nests with the warblers. So I am offering here a simplified explanation for the benefit of field workers with little training in mathematics.

DIFFICULTIES WITH CUSTOMARY METHODS

In studying the nesting success of birds, we want to know how many of the nests *built* produce fledglings and how many of the eggs *laid* hatch and ultimately become fledglings. In fact, these are the terms customarily used in presenting the results of field work. But I believe that these results are often misleading, because the production is actually calculated from nests and eggs *found*—not the same thing as nests *built* and eggs *laid*.

To illustrate, suppose we were to find a series of nests on the eve of hatching. In this special group the "hatching success" would be nearly 100 per cent, and subsequently the "nest success" and "success of eggs to fledging" would be almost twice as high as if these nests had been discovered at the start of incubation. No such extreme example is likely to occur in field work, but the problem exists to a variable and unknown extent in nearly all studies of birds with concealed nests. Only among birds whose nest sites are under observation before the birds use them, such as those using artificial cavities, are all the records likely to be complete from the very beginning.

Of course, if all nests were discovered with the first wisp of building material and followed through to termination, analysis would present few difficulties and this discussion would be unnecessary. In truth, however, the raw data are not likely to be as tidy as the published summaries would seem to indicate. With open-nesting altricial birds, typically, the field worker finds a few nests

during the building stage, a very few during the egg-laying stage, a larger number during the incubation stage, and perhaps the greatest number during the nestling stage. Thus, his records include nests found at every way station of development, and these are somehow lumped together to calculate "success," expressed perhaps as percentages of nests *built* and eggs *laid* although few of the nests were found when just built or when the eggs were just laid.

How serious an error this may be can be seen in another hypothetical example, a little more realistic than the previous one but still simplified enough for easy comprehension without mathematics. Suppose we were to find an equal number of eggs on each day of the incubation period. It is intuitively obvious that the losses observed up to hatching time will be only about half what they would have been if we had found each nest at the start of incubation. That is, many of these nests were well on their way to success when found, or, saying it another way, a good many unsuccessful nests were lost before we got there and thus escaped our attention. Now suppose this series yields a fairly typical apparent "hatching success" of 60 per cent of eggs *found*, or a mortality of 40 per cent of eggs *found*. But, egg mortality occurs mostly through destruction and desertion of entire nests, and we have recognized that nest losses are not adequately represented in our sample. Consequently, the true "success" of the species is very much lower than the apparent success we have calculated from nests found. Similarly, we may wonder if the true success of many open-nesting species is less than the published percentages.

In some studies the discrepancies may not be so great as those in my hypothetical examples, because life-history workers often make a special effort to find nests early. But how can we be sure? Are these factors consistent from one study to another? In one species it may be harder to find nests early than in another. One observer may not be on the nesting ground as early in the season as another. It is unsettling to think that nesting success and mortality reported in studies may be in part an artifact of nest-finding practices.

Indeed, a mortality or survival rate has meaning only if a period of *time* is specified; and, if the period is not stated in units of time, the rate will be assumed to apply to the entire stage of existence under consideration. That is, a mortality or survival rate given for the incubation period is presumed to be based on observation from the very start of incubation.

Yet, if observers throw out all records except those on nests found before the start of incubation, their study samples are likely to become very small (at a serious cost in reliability), and also much useful information may be discarded.

This brings us to another subtlety in quantifying our nesting data. Sometimes observers are unable to follow every nest through to a conclusion and

so have fragments of information on nests whose outcomes are unknown. What should they do with these fragments? Cautious individuals may exclude these from their calculations. Yet, to do so, inflates the mortality rates; that is, a nest destroyed quickly is likely to be included because its fate is known, while a nest that endures until after the observer has departed is likely to be disqualified because its outcome is unknown. On the other hand, other individuals, eager to report as many nests as possible, may include these nests, enlarging the sample without enlarging the losses. To do so, understates the mortality. Here is an awkward dilemma: either to include or to exclude nests with outcome unknown threatens to distort the results.

NEST-DAY AS A UNIT OF EXPOSURE

There is a way out of these difficulties. Briefly, it recognizes that the number of nests lost will vary with the number of nests and also with the time span covered by the observations. The combination of these two—nests and time—I call exposure.

A convenient unit of exposure is the nest-day; that is, one nest for one day. Thus, a nest under observation for ten days represents an exposure of ten nest-days, which is equivalent to the exposure of ten nests for one day each, or five nests for two days each, or any combination of nests and days whose product is ten. Thus, the total exposure of a group of nests is the summation of all the days spanned by observation at each nest. (For some calculations greater precision may be offered by a smaller unit, the egg-day; but, for simplicity, I will restrict myself chiefly to the nest-day in this discussion.)

Nests seen only once are not counted because they do not span any period of time. A nest seen on two consecutive days represents an exposure of one nest-day. A nest in existence five days after it was found represents an exposure of five nest-days whether it was visited many times or only at the end of that interval. A nest lost during an interval of several days is arbitrarily assumed to have been lost on the day at the middle of the interval. All days spanned by observation are included even though no change occurs.

Now we can utilize fragments of information and combine them into a meaningful whole. We can calculate the probability of survival looking backward or forward in any period for which we have survival rates, just as the insurance actuary predicts survival at any stage of human life. Also we can combine scanty bits of information from different observers, the only kind of information we are likely to have on certain elusive species for a very long time.

NEST MORTALITY DURING INCUBATION

To illustrate this method of analysis, we may consider my data on the Kirtland's Warbler, examining first the incubation period. My data on 154 nests

of the Kirtland's Warbler seen during incubation represent a total exposure of 878 nest-days. It is of interest that 10.3 nest-days is equivalent to the average life of one of these nests during incubation (Mayfield, op. cit.), and therefore if I had been so fortunate as to have had information on all these nests from the very start of incubation up to hatching or termination short of hatching, I would have had nearly twice this exposure. It is worth noting also that if I had included only nests with outcome known, I would have been able to use information from only 113 instead of 154 nests.

In this sample I recorded 35 nests lost (19 destroyed and 16 deserted) in 878 nest-days exposure during incubation. So the mortality rate is 35 /878 = .040 nests lost per nest-day during incubation.

Now, knowing the attrition per nest-day, we can calculate the losses back to the start of incubation even though not many of our nests were observed from the very start. In fact, we can take a sample at any point and calculate the probable number in existence on any earlier or later day within the incubation period.

For example, suppose we have 100 Kirtland's Warbler nests incubating. By tomorrow, we can expect to lose four of these nests; by the following day, 4 per cent of the remainder; and on any succeeding day, 4 per cent of the previous day's remainder. Thus, at first we lose almost four nests each day, but as the sample shrinks, so do the losses. When only 75 nests are left, the losses shrink to three a day. It is like compound interest in reverse; the principal shrinks while the rate remains the same.

Here we assume that the hazards of existence are constant throughout the incubation period. Inspection of my data suggests that this is at least approximately true, although I do not have a sufficiently large number of early and late losses to prove conclusively that they are as likely to occur in one part of incubation as another. This assumption is supported also by the fact that I have been unable to detect any change in the behavior of the bird that would appear to increase the vulnerability of the nest early or late in the incubation period. (If this assumption should need modification in some species—for example, if losses are greater early in incubation—this fact will send even farther astray the customary method of ignoring losses before nests are found; the greater the early losses, the more the results will be distorted by including nests not found at the very start of incubation.)

NEST SURVIVAL DURING INCUBATION

The *losses* are directly proportional to the exposure; so thus far, I have used only the *mortality* rate. For some calculations, however, it is more convenient to use the converse, the survival rate. For example, suppose we have 100 Kirtland's Warbler nests under incubation; then tomorrow, as shown in the

previous paragraph, we can expect to have 96 of them left; the following day 96 per cent of 96 ($.96^2 \times 100$); and on each following day 96 per cent of the preceding day's remainder ($.96^3 \times 100$, $.96^4 \times 100$, ... and so on to the end of incubation). Now, in the Kirtland's Warbler, with an average incubation period of 14 days, the probability of survival for the incubation period is $.96^{14} = .56$. That is, 100 nests at the start of incubation would be expected to shrink to 56 nests at hatching time.

Generalizing and expressing the result in better mathematical form, the probability of survival of nests with a mortality rate r for a period of days d is $(1 - r)^d$; or, since $1 - r$ is the survival rate S, the probability of survival is S^d.

NEST SURVIVAL DURING NESTLING PERIOD

When young hatch, of course, the hazards of existence for the nest change abruptly. But we can proceed with our calculations in a similar way, using new mortality and survival rates, as follows: I have records on 144 nests of the Kirtland's Warbler observed during the nestling period, with a total exposure of 735 nest-days. In this group, 22 nests were lost, 19 of them destroyed and 3 deserted. (It is interesting to note that the rate of destruction of nests is virtually unchanged from the incubation period but the rate of desertion is much lower.) So the mortality rate for nests during the nestling period was $22/735 = .030$ nests per day, and conversely, the survival rate was .97. Since the young Kirtland's Warbler usually leaves the nest at the age of nine days, the probability of the nest's survival for the nestling period is $.97^9 = .76$.

NEST SURVIVAL FROM START OF INCUBATION TO FLEDGING

These figures drawn from different nest periods and different samples may be combined, through the mathematical principle that the probability of two successive events is the product of their separate probabilities. Hence, the probability that Kirtland's Warbler nests will survive both the incubation and the nestling periods—that is, from the start of incubation to fledging—is $.56 \times .76 = .43$.

EGG SURVIVAL DURING INCUBATION

The Kirtland's Warbler, unmolested by the cowbird, loses very few eggs without loss of the entire nest; so egg survival is virtually equivalent to nest survival during incubation.

To appraise this matter more precisely, it may be calculated from the loss of six individual eggs during an exposure of 3,181 egg-days that the mortality among eggs was .002 eggs per egg-day and that the probability of survival for 14 days was $.998^{14} = .97$. That is, 97 per cent of eggs starting incubation may be expected to be present at hatching time if no nests are lost. Here the loss of individual eggs is so small there is some question if this factor need be

included in the analysis. In small samples the imprecision in basic data may not justify such refinement in computation. But, with other species, losses of this kind may be significant, and, for illustrative purposes, this small shrinkage will be treated here along with the other losses.

Combining the two probabilities just calculated, we have .56 (probability of nest survival during incubation) $\times$.97 (probability that eggs will survive individual loss) = .54 (probability of egg survival during incubation).

NESTLING SURVIVAL DURING HATCHING PERIOD

Before we can link egg survival during incubation to nestling survival in order to get production of fledglings from eggs that start incubation, we need to know the hatching success of the eggs present at hatching time.

Here again our observations are not likely to be as exact as figures seem to imply. Unless every nest is under constant scrutiny—a rare circumstance—it is impossible to be sure exactly how many eggs hatch. For example, a nest containing five eggs one afternoon may contain one egg and three newly hatched young when visited the next morning. What happened to the missing egg? Are we justified in saying it did not hatch? Perhaps it hatched and then was removed by predator or parent.

The parent Kirtland's Warblers remove dead nestlings and damaged eggs promptly. A young bird that pips its shell but does not emerge fairly soon is in danger of removal, as is an egg with shell pierced by bill or claw. Therefore, I have not attempted to separate hatching success from individual survival in the first few hours of life, but consider these two questions under one heading, survival of the hatching period. For this species, it seemed proper to define the hatching period as the two days following the hatching of the first egg in the same nest. (Some Kirtland's Warbler eggs hatch as much as a day later than others in the same nest but never as much as two days later.)

In my sample, among 182 warbler eggs present at hatching time, in nests without cowbird eggs, 142 nestlings were present two days after the first hatched in each nest. So the probability of survival of the hatching period was $142/182 = .78$.

The probability of survival of individual birds through the hatching event is quite aside from the hazards of existence for each nest as a whole. Therefore, the two days designated as the hatching period must be considered again when we weigh the hazards causing the loss of whole nests (destruction and desertion) rather than the loss of individuals in a nest that survives.

NESTLING SURVIVAL

In the absence of cowbirds, virtually the only losses of individual Kirtland nestlings (without loss of entire nests) occurs in the first day of life. (I have

only one instance of such a nestling lost after the first day and it disappeared on the second day.) Since losses of newly hatched birds were already treated in survival of the hatching period, the probability of survival of nestlings is virtually the same as of nests, which, calculated previously, was .76.

EGG AND NESTLING SURVIVAL FROM START OF INCUBATION TO FLEDGING

Finally, we sum up production for the entire duration of the nest by combining the probabilities for each step, as follows: .54 (probability of egg survival during incubation) × .78 (probability of nestling survival during the hatching period) × .76 (probability of nestling survival to fledging) = .32 (probability that eggs at the start of incubation will produce fledglings).

This figure is approximately the production from eggs *laid*; but, to be perfectly precise, we should be aware that up to five days may elapse between the laying of the first egg in a clutch and the start of incubation. Hence, there is some exposure and loss (not treated here) before the start of incubation. In the species used as an example here, I believe this source of shrinkage much less important than those treated in this paper.

SUMMARY

A field worker analyzing data on nest success may be dealing with a sample in which comparatively few nests were found before the start of incubation. Also, his sample may include some nests for which the outcome was unknown. If such partially complete records are included (or excluded) from his calculations, there is danger of distorting the conclusions. "Percentage of nests *found*" is not the same as "percentage of nests *started*" unless every nest was observed from the very start.

One way of dealing with this problem is to reduce the data to units of *exposure*, which reflects not only the number of nests but also the length of time each was under observation. A convenient measure of exposure is the nest-day (equivalent to one nest for one day). With this approach, all observations covering one or more days each can be incorporated into the sample, even though some of these do not go back to the very beginning and do not carry through to the end. By this method, small fragments of information can be combined into a coherent whole. This may be the only kind of information available for a very long time on many elusive species.

After mortality and survival rates are expressed per nest-day, the probability of survival may be calculated for all or any part of the nesting period. If the survival rate per nest-day is S, the probability of survival of a nest for d days is S^d. The rate during incubation is different from the rate during the nestling period, so these two stages must be treated separately. Also, egg survival must be considered separately from nest survival because of the loss of individual eggs, particularly at hatching time. The probabilities of survival in different stages of nesting may be combined through the mathematical principle that the probability of a succession of events is the product of their separate probabilities.

Each step in these calculations is illustrated with facts from my previously published study of the Kirtland's Warbler, with calculations simplified by considering only those nests in the larger study that were not parasitized by cowbirds.

RIVER ROAD, RFD, WATERVILLE, OHIO, 3 JULY 1961

KERMADEC PETREL IN PENNSYLVANIA

DONALD S. HEINTZELMAN

THE accidental appearance of a Kermadec Petrel (*Pterodroma neglecta*) at the Lookout at Hawk Mountain Sanctuary in eastern Pennsylvania, on 3 October 1959, adds a new species to the avifauna of North America. Identification of the bird as *P. neglecta* has been made by Dr. Robert Cushman Murphy of the American Museum of Natural History in New York City.

Most appearances of accidentals among oceanic birds can be attributed to the presence of meteorological disturbances passing through the area in which the birds were seen. The usual factor involved is a hurricane. Murphy (1936:53) expresses an opinion regarding hurricanes and accidentals as follows:

> From evidence connected with the "trapping" of birds within the vortex of a cyclonic storm, and with the occasional conveyance of strong-winged species of sea fowl from the eastern equatorial Atlantic to points far in the interior of North America, I am inclined to believe that an ocean bird might be carried along within the so-called "eye" of a hurricane because, when once entrapped, it would tend constantly to rebound away from the periphery of gales, and thus to retreat toward the quieter center.

Dr. Murphy cites the cyclone of August 1933, in which a South Atlantic sea bird and an eastern Atlantic sea bird were carried to New York State and Ontario, Canada, respectively. He continues,

> ... it seems to me altogether probable that the birds of the two species referred to were actually caught *inside* the swirl of this storm. Under such circumstances, they might be carried along without becoming panicky, without experiencing any sense of difficulty, feeding normally, and tending always to turn inward toward the calm of the slow-moving center when they had flown far enough in one direction to come into heavily wind-whipped waters. The system as a whole, by the way, was moving forward during this period at a rate not exceeding 25 kilometers per hour. Only when the vortex came into close proximity with the land, as I conceive the situation, would the birds thus held in unconscious durance begin to fight the gales, perhaps to be carried into the higher altitudes of the atmosphere and to be buffeted as helpless waifs for long distances overland before being cast out centrifugally, subsequently to fall exhausted.

He then states that he is able only through the above explanation, to comprehend "... the transportation of Black-capped Petrels from points east of the Caribbean to the Mississippi Valley, or of Madeira and South Trinidad Petrels from the central or eastern north equatorial Atlantic to Ottawa and Ithaca, respectively." In the case of *P. neglecta*, the subject of this paper, Hurricane Gracie was probably responsible for carrying the bird to Hawk Mountain Sanctuary.

An explanation of Hurricane Gracie, from its beginning to the time it reached the Pennsylvania border will be of interest in determining the pres-

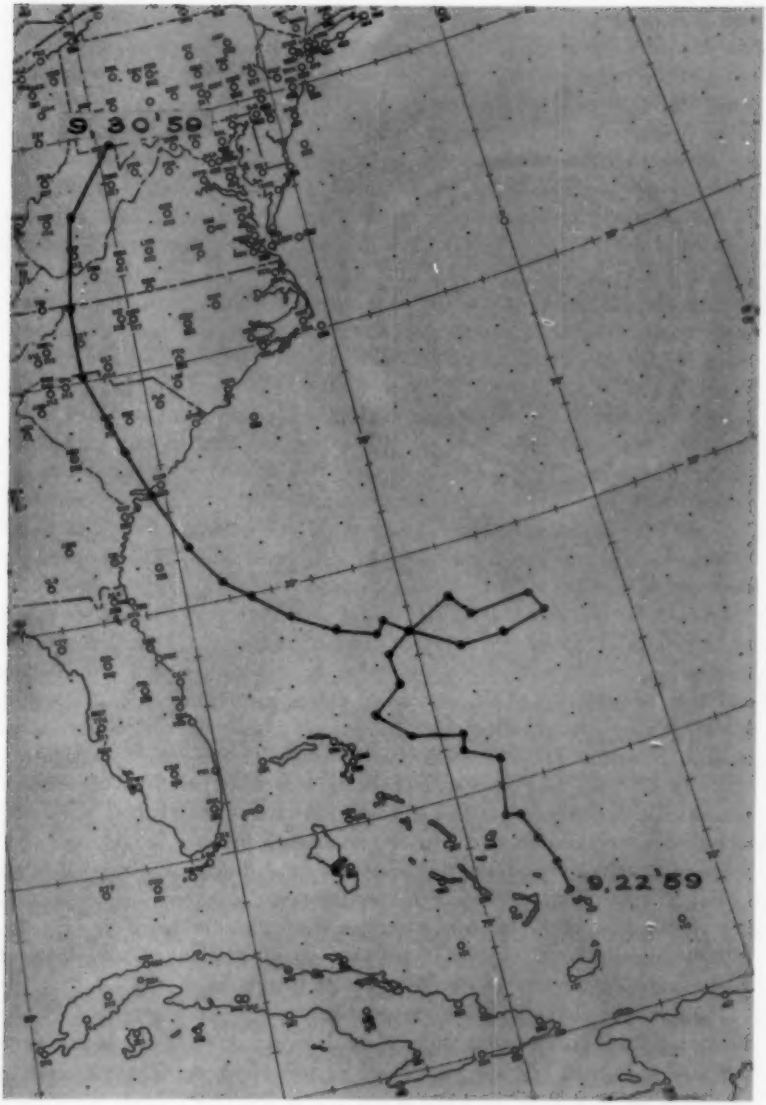

FIG. 1. Map showing the course of Hurricane Gracie from 22 September 1959 to 30 September 1959.

ence of *P. neglecta* far from its normal range. The United States Weather Bureau recorded the storm as a hurricane for the first time on 22 September 1959, in the Bahamas, and it was probably somewhere in that area that the petrel was entrapped. As the storm proceeded north (Fig. 1), it made a loop in the Atlantic Ocean and then proceeded again on its northward course. On the morning of 30 September 1959, eight days after its detection and classification by the Weather Bureau as a hurricane, Gracie entered Pennsylvania. By that evening it was west of Allentown, Pennsylvania, but at that point the velocity of the winds had greatly subsided and the Weather Bureau stopped collecting data on it.

Three days later *P. neglecta* was observed at the Lookout at Hawk Mountain Sanctuary. This is an extremely interesting record because the normal range for the species (Murphy, 1936:705) is the "Sub-tropical Zone of the South Pacific Ocean; breeding at Mas Atierra and Santa Clara Islands of the Juan Fernández group, San Ambrosio, numerous islands of southern Polynesia, and at the Kermadecs and Lord Howe Islands in the western part of the ocean; ranges northward in the eastern Pacific into the northern hemisphere." Murphy (1936:706) quoting Loomis (1918:102) has shown that "... the Kermadec Petrel migrates northward in the eastern Pacific to about latitude 15° N., where two examples were collected and others observed by Beck during October, 1906."

Pterodroma neglecta is described (Murphy, 1936) as a dichromatic petrel which occurs in two color phases: black and light brown. A number of intermediates are also found, which range from light specimens with white bellies and very light throats and heads, to very dark specimens which are almost black. White areas on the throat, wings and usually elsewhere are always present, however. The concealed basal portions of the entire plumage are white in all color phases, which produces a mottling even in the darkest phases. All the birds, regardless of color, have the shafts of their primaries, as well as a greater part of the inner web of each primary, largely and conspicuously white. *Pterodroma neglecta* may be distinguished from all other closely related forms, including *P. arminjoniana*, by these characteristics. The whitish base of the rectrices is another distinctive characteristic (Fig. 2). Murphy and Pennoyer (1952:6) give excellent illustrations of wing patterns in the genus *Pterodroma* to which the reader is referred.

The adults in the dark phase (sexes alike) vary in their general color between a grayish brown and a dark brownish black. A white mottled area appears on the throat and also to a lesser degree elsewhere. The quills of the wing and tail, including the white shafts, are as described. Birds in the dark phase have legs which are black, whereas specimens in the intermediate phases are parti-colored.

FIG. 2. A view of the ventral surface of *Pterodroma neglecta* showing the white wing patches, whitish base of the rectrices, and the petrel bill which is shorter than that of the shearwaters. Photo from a 16 mm Kodachrome motion picture.

Pterodroma neglecta was observed for a period of about five minutes (1:00 to 1:05 PM, EST) on 3 October 1959. The weather was very cloudy and the light was quite dim. A Weston exposure meter did not record more than 50 foot-candles. The bird circled the Lookout at varying heights—at times only 40 feet above the approximately 40 observers who were present and saw the bird. I was able to secure 50 feet of 16mm Kodachrome motion pictures showing both the dorsal and the ventral surfaces of the bird as it circled overhead. It was last seen flying in a northwest direction toward the upper Susquehanna River and New York State.

Because of the poor lighting conditions, only 36 feet of film are usable, but they clearly show the conspicuous white wing patches against the dark

FIG. 3. Head and bill of *Puffinus griseus* (left) and *Pterodroma neglecta*. Drawn by Dr. Earl L. Poole from skins in ANSP.

plumage of the body on the ventral surface of the bird. Furthermore, the whitish base of the rectrices may also be seen (Fig. 2).

Since I am unfamiliar with oceanic birds, I sent the film to Dr. Murphy and requested his opinion regarding the identification of the bird. His reply, in part, follows:

> The short strip of motion pictures of your seabird is far more revealing than I had anticipated. It is not a Sooty Shearwater (as one ornithologist suspected). That species has a white wing lining as conspicuous as the Black Duck's. Furthermore, your bird is not a *Puffinus* of any sort. Its bill (see comparison of Figs. 2, 3) and its style of flight show that it is a member of the genus *Pterodroma*.
>
> On geographic grounds, the most likely petrel would be *Pterodroma arminjoniana* from the south Atlantic which has once been taken at Ithaca, New York (Murphy, 1936:53) after a hurricane (see also Allen, 1934:134). Careful examination of the film appears, however, to rule out that species. My final conclusion is that this petrel can be nothing else than *Pterodroma neglecta* in the dark plumage phase. There is no other species that shows the conspicuous white wing patch against a generally black plumage.
>
> Under separate cover I am sending you a systematic paper of my own (Murphy and Pennoyer, 1952) and I call your attention to the diagrams of wing pattern on page 6. These figures and the text will supply the grounds for my conclusion. On the other hand, I suppose that my memory of the living birds influences me quite as much as the facts of description.

My photographs, along with the drawing (Fig. 3) by Dr. Earl L. Poole, which illustrate this paper, serve as another means of comparison between the genera *Puffinus* and *Pterodroma*.

Dr. Murphy has the following opinion regarding records for this bird in North America: "*Pterodroma neglecta* has probably not previously been recorded from the north Atlantic area . . . many members of the genus have turned up as stray birds in odd corners of the world. I believe that *neglecta* has been recorded in the same way from somewhere in Europe." The single record of *P. neglecta* in Europe is a male which was picked up dead in Tarporley (Cheshire), England, on 1 April 1908 (Witherby et al., 1952:63).

The latest edition of the AOU Checklist includes no records for this species in North America. This then is the first record for *Pterodroma neglecta* on the North American Continent.

ACKNOWLEDGMENTS

I would like to express my appreciation to the various members of the Departments of Birds in the Academy of Natural Sciences of Philadelphia, American Museum of Natural History, and Smithsonian Institution who placed series of specimens of various shearwaters and petrels at my disposal for comparison purposes. My sincere appreciation is also due Dr. Earl L. Poole, who examined the manuscript, made several suggestions, and also prepared the drawings of the head and bill of the Sooty Shearwater and the Kermadec Petrel. Finally, my deepest appreciation must be extended to Dr. Robert Cushman Murphy who, on several occasions, critically examined my color motion pictures of the petrel and expressed his opinion as to the identification of the bird..

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629 GREEN STREET, ALLENTOWN, PENNSYLVANIA, 22 JUNE 1961 (ORIGINALLY SUBMITTED 4 MARCH 1960)

NEW LIFE MEMBER

New life member Simon Rositzky, of St. Joseph, Missouri, is interested in ornithology primarily through field work. A graduate of the University of Missouri, Mr. Rositzky is now president of United Department Stores, the father of two teenage daughters, and actively works with Boy Scouts. He was president of the St. Joseph Audubon Society, is a member of the board of directors of the St. Joseph Museum, and is an active member of the National Audubon Society and the American Museum of Natural History.

OCCURRENCE AND TIMING OF EGG TEETH IN BIRDS

GEORGE A. CLARK, JR.

THE egg tooth is a small tooth-like protuberance on the distal end of the dorsal surface of the upper mandible at the time of hatching. It is generally believed that the egg tooth functions in cutting through the shell membranes and shell at hatching. In addition to egg teeth on the upper mandible, a number of authors have noted tooth-like modifications of various kinds at the tip of the lower mandible in embryos or newly hatched birds of a variety of families. The objective of this paper is to present an extended review of scattered records of egg teeth as a stimulus and aid for further studies on the morphology, function, development, and evolution of these structures.

In spite of the great significance of hatching in the life of the bird, very little is known of the causal relations involved in the process. Certain correlated events such as respiratory, circulatory, and behavioral changes are known, but in no case have the factors responsible for the timing of hatching been specifically identified. The role of the egg tooth in hatching also needs further study. Fisher (1958) studied the development in the chicken of the hatching muscle which may be important in the functioning of the egg tooth. It has been suggested that the hatching muscle provides a major part of the thrust in breaking through the shell. The egg tooth is possibly unique as a structure functional only at the time of hatching. Many species appear to have characteristic patterns of hatching as shown by the condition of the shells after hatching (Wetherbee, 1959). In the European Quail (*Coturnix coturnix*), for example, the blunt end of the shell is almost entirely cut off with a precise circular incision.

The egg tooth of the upper mandible has been studied in detail for only a very few species. A modern histological study of the egg tooth is that of Kingsbury, Allen, and Rotheram (1953) on the chicken. Detailed comparative studies are needed to determine the homologies of the egg teeth of both upper and lower mandibles within the class Aves. In some groups (e.g., penguins and Falconiformes) the egg tooth of the upper mandible typically remains visible for several weeks posthatching, while in other forms (e.g., many Galliformes) loss of the egg tooth characteristically occurs within a few days posthatching (Table 1). Gardiner (1884) suggested that there is a tendency for nidicolous species to retain the egg tooth longer than do nidifugous ones. The physiological and environmental factors involved in retention or disappearance of egg teeth are virtually unstudied.

Gadow (1891) and others have stated that the egg tooth in birds was first noted by Yarrell (1826), but Anson (1929) reported two earlier observations: Aldrovandi in 1600 and Hunter in 1793 (the latter report not published until 1841). Gadow (1891) stated that the egg tooth is to be found in the embryos of

TABLE 1

TIME OF DISAPPEARANCE OF THE EGG TOOTH IN VARIOUS BIRDS

A. The egg tooth is reduced or disappears before hatching:
   some Megapodiidae
B. The egg tooth disappears during the first week posthatching:
   Hydrobates pelagicus (Hydrobatidae)
   Eudocimus albus (Threskiornithidae)
   some Anatidae
   some Galliformes
   Rallus elegans (Rallidae)
   some Scolopacidae
   some Passeriformes
C. The egg tooth disappears after the first week posthatching:
   some Spheniscidae
   Procellaria grisea (Procellaridae)
   some Falconiformes
   some Otididae
   Cepphus grylle (Alcidae)
   Turacus hartlaubi (Musophagidae)
   Tyto alba (Tytonidae)

all birds, but evidence for this opinion was not presented. The data here compiled support Gadow's claim, but the chance of finding species without egg teeth remains. It appears that in most branches of avian phylogeny the egg tooth has been developed or retained as an integral part of the hatching process.

Failure of an observer to find an egg tooth on a newly hatched bird does not necessarily indicate that an egg tooth is absent in that species; absence of an egg tooth in a particular specimen may be an age variation rather than a species-specific character. Within a species there may well be wide variation in the time of disappearance of the egg tooth; precise data are needed on this point.

In reptiles at least two types of egg teeth are known: one a true dentinal structure and the other of integumental origin. Only the latter type of egg tooth is known from birds. Some authors have restricted the term "egg tooth" (*Eizahn*) to egg teeth of dentinal character; such terms as egg callosity (*Eischiele*), "egg caruncle," "shell breaker," or "pipping tooth" are used for the structure found in birds. However, the term "egg tooth" is so widely used for the avian integumental derivative that there seems little to be gained by a change of terminology.

No attempt has been made in this paper to review all the published records of egg teeth. A primary concern has been to find records for as many of the major groups of birds as possible. Many records undoubtedly have been missed. In addition to checking several hundred published articles and books, I have

examined study skins and alcoholic specimens at the Yale Peabody Museum of Natural History. Examination of specimens at other large museums would unquestionably yield many additional records of egg teeth.

SYSTEMATIC ACCOUNT

Spheniscidae.—The egg tooth is known for the following species: *Aptenodytes forsteri* (Pycraft, 1907*a*), *Pygoscelis papua* (Murphy, 1936), *P. antarctica* (Parsons, 1932), *Eudyptes chrysocome* (= *E. crestatus*; Lewin, 1903), and *Eudyptula minor* (Grossenheider, 1952).

Struthionidae.—Rõse (1892) and Schneider (1949) reported and figured the egg tooth of *Struthio camelus*. Schneider's figures of the newly hatched bird suggest the presence of a well-developed hatching muscle.

Gaviidae.—A study skin of a downy *Gavia immer* bears an egg tooth on the tip of the upper mandible. Stresemann (1927–34) commented that newly hatched loons have a tooth-like callosity on the tip of the lower mandible.

Podicipedidae.—Egg teeth were found on downy study skins of *Colymbus chilensis* and *Aechmophorus occidentalis*. Simmons (1955) observed an egg tooth on the distal quarter of the upper mandible of a downy *Colymbus* (= *Podiceps*) *cristatus*.

Procellariidae.—The white egg tooth of the chick of *Procellaria grisea* disappears between 11 and 22 days posthatching with 17½ days being the average time (Richdale, 1945).

Hydrobatidae.—Davis (1957) noted that in *Hydrobates pelagicus* the white egg tooth is retained to about six days posthatching.

Pelecanoididae.—A prominent white egg tooth on a chick of *Pelecanoides urinatrix* of an estimated age of two days posthatching was observed by Richdale (1943).

Phalacrocoracidae.—Lewis (1929) found that the egg tooth of the upper mandible of *Phalacrocorax auritus* is lost about four days posthatching. The whitish tip of the lower mandible has the appearance of an egg tooth and is retained much longer than the egg tooth of the upper mandible. Boetticher (1928) figured the egg tooth of *P. carbo*.

Ardeidae.—Sushkin (1912) reported and figured the egg tooth of *Ardea cinerea*. Heilmann (1927) also figured the egg tooth of *Ardea*.

Threskiornithidae.—Beebe (1914) reported that the egg tooth of *Guara alba* (= *Eudocimus albus*) is lost about the third day posthatching.

Anatidae.—Yarrell (1826) noted the egg tooth in ducks and geese, especially *Alopochen aegyptiacus*. Heilmann figured the egg tooth of *Somateria*. According to Romanoff (1960), *Anas platyrhynchos*, *Anser anser*, *Cygnus*, and *Mergus* lose the egg tooth a few hours after hatching. Koeche (1958) mentioned the egg tooth in his study of the embryology of *Anas platyrhynchos*. I have observed the egg tooth on the nail of the bill in downy specimens of *Aythya valisineria*, *Netta rufina*, and *Clangula hyemalis*.

Accipitridae.—A prominent white egg tooth present at hatching was lost by three weeks posthatching in *Elanus caeruleus* (Van Someren, 1956). Haverschmidt (1959) found a white egg tooth on a nestling of *Helicolestes hamatus*. Gardiner (1884) figured a tooth-like papilla on the tip of the lower mandible of an embryo of *Milvus milvus*. In *Astur* (= *Accipiter*) *tachiro* a white egg tooth was still present at 12 days posthatching (Van Someren, 1956). Van Someren (1956) found an egg tooth on *Melierax gabar* at least two and one-half weeks posthatching. In *Aquila chrysaëtos* the egg tooth is very noticeable at hatching (Sumner, 1929). As the bill grows, the egg tooth becomes less and less noticeable; at four weeks posthatching the egg tooth is still visible, though very small. Herrick (1932) reported that the egg tooth persists for over a month posthatching in *Haliaeetus leucocephalus*. I have seen an egg tooth in a downy specimen of *Buteo jamaicensis*.

Pandionidae.—P. L. Ames (pers. comm.) found that the egg tooth remained visible in one young Osprey for at least 28 days posthatching.

Megapodiidae.—A vestigial egg tooth in embryos of *Talegalla jobiensis* and *Leipoa ocellata* has been interpreted as one of several characters indicating that megapodes have evolved from gallinaceous birds which hatched relatively earlier in ontogeny (Clark, 1960, and MS). Friedmann (1931) found no egg tooth in an embryo of *Megapodius pritchardii* shortly prehatching; presumably a vestigial egg tooth could be found earlier in the ontogeny of this species. Megapodes are reported to hatch by kicking their way out of the shell (Clark, 1960).

Phasianidae.—Stoddard (1931) noted an egg tooth on a downy *Colinus virginianus*. The development of the egg tooth in *Coturnix coturnix* has been figured by Padgett and Ivey (1960) and Romanoff (1960; after Weber). In this species the egg tooth is lost by the second day posthatching (Clark, MS). A downy specimen of *Gallus gallus* shows an egg tooth. The egg tooth on the upper mandible first becomes apparent in *Gallus domesticus* embryos at seven days of incubation (Hamilton, 1952; Kingsbury et al., 1953). According to Friedmann (1955), Rosenstadt reported an egg tooth anlage on the lower jaw of the chicken embryo. Yarrell (1826) observed that the chicken has lost the egg tooth of the upper mandible by two to three days posthatching. Friedmann (1955:21) erroneously stated that in *Gallus* embryos the egg tooth of the upper mandible is already present at the time of an oral invagination separating upper and lower jaws. Using the figures of Gardiner (1884), Friedmann misidentified the labial groove by calling it an oral invagination; Hamilton (1952:374–375) has given this correct interpretation of Gardiner's study. In embryos of *Phasianus colchicus* the egg tooth is quite noticeable as early as the ninth day of incubation (Fant, 1957). The egg tooth of the Ring-necked Pheasant remains for one or two days posthatching, rarely longer; sometimes the egg tooth is lost as early as five to six hours after hatching (Westerskov, 1957).

Opisthocomidae.—Beddard (1889) and Parsons (1954) noted the egg tooth in *Opisthocomus*.

Gruidae.—Egg teeth have been observed in newly hatched *Grus americana* (Allen, 1952) and *G. canadensis* (Walkinshaw, 1950).

Psophiidae.—Burckhardt (1901*b*) reported an egg tooth for *Psophia crepitans*.

Rallidae.—The egg tooth is lost in *Rallus elegans* between the fourth and sixth days posthatching (Meanley and Meanley, 1958). Walkinshaw (1937) observed the egg tooth in *Rallus limicola*. *Gallinula chloropus* is stated to have a tooth-like callosity on lower mandible (Willink, 1899). Steinmetz (1932) noted the egg tooth of *Fulica atra* (Heilmann, 1927, also figured the egg tooth of *Fulica*). Falla (1951) reported an egg tooth in *Notornis*.

Rhynochetidae.—Burckhardt (1901*a*) noted the egg tooth in *Rhinochetos jubatus*.

Otididae.—Romanoff (1960) commented that bustards retain the egg tooth for several weeks posthatching. Willink (1899) found a tooth-like callosity on the tip of the lower mandible of *Otis afra* (= *Afrotis atra*); Willink also noted an egg tooth on the upper mandible.

Haematopodidae.—Among the variety of species with a tooth-like callosity on the lower jaw is *Haematopus ostralegus* (Willink, 1899).

Charadriidae.—Romanoff (1960; after Rezovska) has reported a small egg tooth on the anterior end of the lower mandible of *Vanellus vanellus*.

Scolopacidae.—Willink (1899) found an egg tooth on the anterior end of the lower jaw of *Numenius* and *Limosa aegocephala* (= *L. limosa*). Romanoff (1960) reported that in *Gallinago* (= *Capella*) *gallinago* and *Scolopax rusticola* the egg tooth of the upper mandible

is lost a few hours after hatching. Wetherbee (1959) was unable to find an egg tooth in a newly hatched *Philohela minor*.

Recurvirostridae.—Willink (1899) observed an egg tooth on the lower mandible of *Recurvirostra avosetta*.

Burhinidae.—*Oedicnemus crepitans* (= *Burhinus oedicnemus*) has an egg tooth on the lower jaw (Willink, 1899).

Laridae.—Tinbergen (1953) commented on the egg tooth in *Larus argentatus* and showed that typically the initial pipping of the shell is directed vertically, either upward or downward. Kirkman (1931) found that the egg tooth is used in hatching in *Larus ridibundus*. Röse (1892) figured the egg tooth on the upper jaw of *Sterna wilsoni* (= *Chlidonias hybrida*). Willink (1899) found an egg tooth on the lower jaw of *Chlidonias nigra*.

Alcidae.—Winn (1950) observed that in *Cepphus grylle* the egg tooth becomes relatively smaller following hatching; the egg tooth disappears between the 25th and 35th day posthatching. Lockley (1953) figured the egg tooth of the Puffin, *Fratercula arctica*.

Columbidae.—Yarrell (1826) and Wetherbee (1959) have noted the typical egg tooth on the upper mandible of *Columba livia*. The egg tooth on the upper mandible of *Zenaidura macroura* is lost about seven to eight days posthatching (Hanson and Kossack, 1957). Both Hanson and Kossack (1957) and Wetherbee (1959) commented on the egg tooth of the lower mandible of the Mourning Dove; Hanson and Kossack noted that the egg tooth of the lower mandible is still prominent at nine days posthatching. Egg teeth have been reported on both upper and lower mandibles in the following species: *Geopelia cuneata*, *Columbina picui*, *Phaps elegans*, *Geophaps scripta*, *Leptotila rufaxilla*, and *Oreopeleia montana* (Minchin, 1933; Newman, 1908). Newman (1908) thought that *Columba* and *Turtur* lack egg teeth on the lower jaw. The egg tooth on the upper mandible of *Phlogaenas crinigera* (= *Gallicolumba criniger*) was reported by Newman (1909).

Psittacidae.—Pycraft (1907*b*) noted an egg tooth on the upper mandible of a nestling *Calopsittacus novae-hollandiae* (= *Nymphicus hollandicus*). Gardiner (1884) reported an egg tooth on the upper mandible of *Melopsittacus*.

Musophagidae.—In *Turacus hartlaubi* the egg tooth disappears about ten days posthatching (Van Someren, 1956). Moreau (1938) found a very small whitish egg tooth on the upper jaw of a newly hatched chick of *Corythaeola cristata*.

Cuculidae.—Shelford (1900) reported and figured an egg tooth in embryos of *Centropus sinensis*. A relatively small egg tooth is to be found on the upper mandible of *Crotophaga sulcirostris* (Skutch, 1959).

Tytonidae.—Pickwell (1948) noted an egg tooth on *Tyto alba* at 13 days posthatching.

Strigidae.—Heilmann (1927) figured the egg tooth of *Nyctea*.

Trogonidae.—The egg tooth has been noted in *Pharomachrus mocino* (Skutch, 1947).

Bucerotidae.—Shelford (1899) examined a late embryonic stage of *Buceros rhinoceros* and noted that the sharp edge of the extreme tip of the large upper mandible could act as an egg tooth, although no actual egg tooth was observed. On the anterior end of the projecting lower mandible is a small tooth-like papilla.

Capitonidae.—Skutch (1944) commented that egg teeth of nestlings of *Dicrorhynchus* (= *Semnornis*) *frantzii* are less prominent than those of woodpeckers (Picidae). Friedmann (1955) noted a tooth-like protuberance on the upper mandible of a nestling *Megalaima asiatica*.

Indicatoridae.—Ranger (1955) reported an egg tooth at the base of the premaxillary hook in a nestling of *Indicator minor*; Friedmann (1955) suggested that the hooks of both upper and lower mandibles of nestling *Indicator indicator* are formed from anlagen homologous to those forming the egg teeth in other birds.

Ramphastidae.—Van Tyne (1929) observed a well-developed egg tooth in young *Ramphastos sulfuratus* (= *R. brevicarinatus*).

Picidae.—In *Colaptes auratus* Wetherbee (1959) found a white covering on the tips of both jaws; this covering resembled egg teeth in color and texture. Friedmann (1955) observed an egg tooth in each of two nestling specimens of *Colaptes auratus*. Lüdicke (1933) found an anlage of an egg tooth in an embryo of *Picus viridis* at five days of incubation. According to Wetherbee (1959), the Heinroths figured a nestling *Picus viridis* showing the whitish tips of both mandibles. According to Friedmann (1955), the Heinroths also reported an egg tooth on the upper jaw of *Dryocopus martius*. Hoyt (1944) described the whitish tips of each jaw of the nestling *Dryocopus pileatus*; these tips are retained until shortly after the young bird leaves the nest. Hoyt was uncertain whether these whitish tips are forms of egg teeth or whether an actual egg tooth appears earlier and is lost shortly posthatching. Egg teeth on the upper mandible of chicks of *Dendrocopos pubescens* have been reported by Friedmann (1955) and Wetherbee (1959). Friedmann (1955) found an egg tooth on a nestling *Picoïdes tridactylus*.

Corvidae.—P. L. Ames (pers. comm.) has seen an egg tooth on a nestling *Corvus brachyrhynchos*.

Troglodytidae.—Armstrong (1955) reported egg teeth in two species of wrens.

Turdidae.—Lüdicke (1933) found anlagen of egg teeth on both upper and lower jaws in embryos of *Turdus merula*.

Laniidae.—Miller (1931) noted that the egg tooth of *Lanius ludovicianus* was undiminished in size between hatching and four days posthatching. In the fifth and sixth day posthatching the egg tooth was less prominent as a consequence of growth of the remainder of the bill.

Callaeidae.—McKenzie (1951) reported that in *Callaeus cinerea* the egg tooth is retained at least one week posthatching.

Sturnidae.—Romanoff (1960; after both Portmann and Weber) has figured the egg tooth of *Sturnus vulgaris*.

Vireonidae.—Southern (1958) noted a prominent whitish egg tooth in the newly hatched Red-eyed Vireo (*Vireo olivaceus*); by the fourth day posthatching the egg tooth had decreased in size.

Icteridae.—Daniel (1957) found that the egg tooth first appears in embryos of *Agelaius phoeniceus* at the seventh day of incubation; the egg tooth is completely formed by 11½ days of incubation. Daniel also found an anlage of the egg tooth on the lower mandible of *Agelaius*. Friedmann (1929) found the egg tooth still present in *Agelaioides* (= *Molothrus*) *badius* at about five days posthatching; the following day the egg tooth was less distinct. Friedmann also observed an egg tooth in *Molothrus rufo-axillaris*. In *M. bonariensis* the egg tooth is still as prominent at three days posthatching as at hatching; the egg tooth is still present at five days posthatching but on the following day is no longer very distinct (Friedmann, 1929). In *Molothrus ater* the egg tooth is still present on the fifth day posthatching; on the sixth day it is no longer distinct. Friedmann (1929) also found an egg tooth in *Tangavius aeneus* at one day posthatching.

Tersinidae.—Traces of an egg tooth are visible in *Tersina viridis* during the first few days posthatching (Schaefer, 1953).

Ploceidae.—Lüdicke (1933) found an anlage of the egg tooth in the canary embryo at seven days of incubation; he also noted an anlage of the egg tooth on the lower jaw in this form. Weaver (1942) briefly described the egg tooth of *Passer domesticus*; this egg tooth disappears by the fourth day posthatching.

Fringillidae.—Orr (1945) observed an egg tooth in nestlings of *Geospiza*. Woolfenden (1956) recorded the egg tooth present as late as the sixth day posthatching in *Ammospiza*.

ACKNOWLEDGMENTS

I am grateful to Mary A. Heimerdinger and Peter L. Ames for information on the egg teeth of various species. Dr. Philip S. Humphrey generously offered many valuable suggestions. This review was prepared using the facilities of the Department of Zoology and the Peabody Museum of Yale University. Financial support was received from the National Science Foundation G-10735.

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DEPARTMENT OF VERTEBRATE ZOOLOGY, PEABODY MUSEUM OF NATURAL HISTORY, YALE UNIVERSITY, NEW HAVEN, CONNECTICUT, 8 SEPTEMBER 1960

NEW LIFE MEMBER

Walter P. Nickell, an active member of the Society since 1943, is an Associate Naturalist in the Science Education Division of the Cranbrook Institute of Science, Bloomfield Hills, Michigan.

Walt has varied interests in ornithology, but especially is he interested in the migration, life histories, and ecology of birds. He has published approximately 100 papers on these subjects and on others in allied fields of entomology, geology, and mineralogy.

Our new Life Member is also a member of the AOU, Cooper Ornithological Society, Detroit Audubon Society (Pres. 1941–1943), Michigan Audubon Society (Board Member), Massachusetts Audubon Society, National Audubon Society, numerous bird banding organizations, Michigan Botanical Club (Pres. 1947–1949), and others.

GENERAL NOTES

Dorsal apterium present in Bobwhite.—In the only existing discussion of pterylosis in the Odontophorinae, Clark (1898. *Proc. U.S. Natl. Mus.*, 21:641–653) stated that the group is characterized by the lack of a dorsal apterium. Of the five genera represented in Clark's study (*Oreotyx*, *Callipepla*, *Lophortyx*, *Colinus*, and *Cyrtonyx*), only *Lophortyx* was described as possessing a trace of a dorsal apterium. Examination of 175 specimens (170 prepared as flat skins and 5 plucked) disclosed that a dorsal apterium is also present in Bobwhite (*Colinus virginianus*). Located in the dorsal region of the spinal tract, the apterium averaged about 2 cm long and less than 1 cm wide.

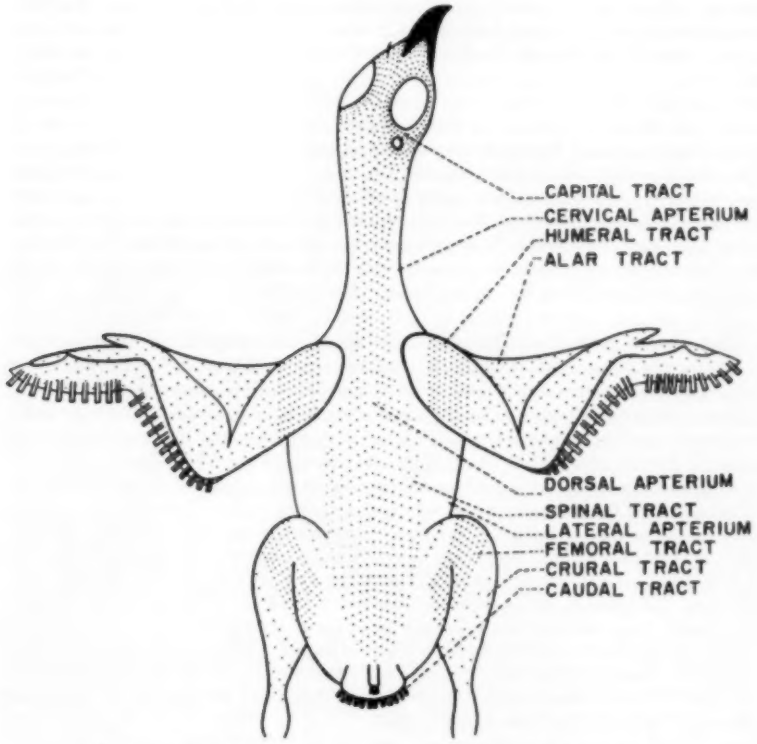

FIG 1. Plucked Bobwhite, dorsal view, illustrating dorsal apterium.

Specimens examined were collected from January to March 1956 in the southern one-third of Illinois. Most were first-winter birds, but those in adult plumage also exhibited the apterium.—LUCY SHARP BREWER, *Cooperative Wildlife Research Laboratory, Southern Illinois University, Carbondale, Illinois, 25 June 1960.*

Copulatory behavior of the Common Loon.—S. T. Olson and W. H. Marshall (1952. The Common Loon in Minnesota. *Occasional Papers:* No. 5, *Minn. Mus. Nat. Hist.*, pp. 27–28) described what they considered to be the courtship of the Common Loon (*Gavia immer*) and stated that copulation had not been observed. They suggested that the act was performed at night. Thus, the following description of copulation is perhaps the first recorded for the species.

On 14 June 1960, I observed two loons at the Crex Meadows Wildlife Area (Grantsburg, Burnett County, Wisconsin) which behaved in a manner similar to that described by Olson and Marshall (op. cit.). While driving along Phantom Lake dike I noticed at a distance what appeared to be a white-capped wave moving irregularly across the lake. As I drove nearer I distinguished the heads of two loons above the churning water. The birds skimmed over the water at varying speeds, striking the surface with powerful wing beats. The pursuing bird was never more than a few feet behind the lead bird. Occasionally the birds gave a great burst of speed lasting for 15 to 20 feet. The first uninterrupted chase covered a meandering course of several hundred feet. After stopping, both loons stood upright, stretched their wings, and dived. After surfacing, one bird started another wing-splashing treck across the water and was soon followed by the second loon. Several other pursuits of shorter length followed. During these the lead bird appeared to be tiring and slowed down. The pursuer seemed less tired and overtook and mounted the lead bird. Togther they submerged like an overweighted object. After about 40 seconds they surfaced at the same location, one still on top of the other. The top bird slipped off immediately and both birds swam about slowly for a few minutes. One or two short, less vigorous, chases occurred and then the birds left for another part of the lake.—WILLIAM E. SOUTHERN, *Department of Biological Sciences, Northern Illinois University, DeKalb, Illinois, 11 July 1960.*

Cattle Egrets in Mexico.—The remarkable spread of the Cattle Egret (*Bubulcus ibis*) northward from South America has been recorded through the islands of the West Indies and in the Gulf and Atlantic coastal areas of the United States. The only previously published reports of this egret from eastern Mexico, a logical route for its dispersal, appear to be of the individuals noted in Quintana Roo near Chetumal on 16 December 1956, and on Cozumel Island, 8 January 1959 (R. Denham, 1959. *Auk*, 76:359–360). The following additional records of its occurrence to the northward in Mexico are of interest. On 13 April 1959, B. L. Monroe, Sr., and B. L. Monroe, Jr., saw nine birds two miles south of Panuco, Veracruz, near the Tamaulipas border. D. M. Lay and D. G. Berret noted seven Cattle Egrets on 22 April 1959, two miles south of Miramar (near Alvaro Obregón), Tabasco. In 1960, D. M. Lay and J. E. Woods observed about 50 birds on 29 February near Huastecas, Tabasco, 18 miles north of Teapa. The following day in the same locality they found 150 Cattle Egrets and collected a specimen. These observers and J. Gee also noted the egrets there on 25 and 30 March. We found a Cattle Egret in a wet field 2.4 miles west of Ciudad Lerdo on the main road between San Andres Tuxtla and Alvarado, Veracruz, on 13 March 1960.—ROBERT F. ANDRLE, *Louisiana State University, Baton Rouge 3, Louisiana*, and HAROLD H. AXTELL, *Buffalo Museum of Science, Buffalo 11, New York, 3 August 1960.*

Long-tailed Jaeger in Ohio.—On 20 October 1956, an immature jaeger with an injured wing, found two days earlier near Ashtabula, Ohio, on a road near Lake Erie, was brought to me. It had been kept in a small basement room, where it had apparently consumed very little of the food and water offered it.

I had the feathers of the injured wing clipped, and kept the jaeger in a large box indoors. It was given exercise in the yard every day, and placed in a large tub of water two or three

times a day. Although a pan of water was also available, the only observed drinking was done when in the tub. Each day the bird accepted six or seven finger-sized fish or similar-sized strips of larger fish, and about ten pieces of fish-flavored cat food molded to the same size. Such food was taken freely when dangled in front of the bird, but not from the floor unless dropped there by the bird itself. When it ate more than about three pieces at a time (it would take five or six), it would regurgitate the extra pieces with violent effort and pay no further attention to them, or to more food proffered at that time. It seemed to be in vigorous health, frequently tried to fly, and became quite tame, allowing its head to be stroked and not objecting to some handling when shown to visitors.

On 10 November, after about ten minutes in its tub, it was found dead from no obvious cause. Shortly after death it was examined by Drs. Harry C. Oberholser and Owen Davies, and identified as a Long-tailed Jaeger (*Stercorarius longicaudus*). The specimen, apparently the second for Ohio (Trautman and Walker, 1930. *Auk*, 47:242), has been deposited in the University of Cincinnati Museum.—Edwin Novotny, *97 W. 44th St., Ashtabula, Ohio, 8 July 1960.*

Purple Martins nesting in city buildings.—On 29 May 1960, I discovered four pairs of Purple Martins (*Progne subis*) nesting in crevices and cavities of a two-story brick building on the main street of Ottawa, Franklin County, Kansas. The birds were using the building housing the Kramer Drug Store, near the corner of Second and Main streets. The side of this building facing the street has its upper edge (approximately 40 feet high) ornamented with 14 objects resembling one-gallon tin cans suspended on their sides. About one-half of these have one or both ends, or their base attachments, partly or fully broken away, allowing entrance to the interior by the birds. Besides the four pairs of martins, Starlings (*Sternus vulgaris*) and House Sparrows (*Passer domesticus*) were nesting in these ornaments. The martins all appeared to be adults; two pairs behaved as if incubating and another as if feeding young on 2 June, when Richard F. Johnston and I visited Ottawa and observed the birds.

Although several other buildings seemed to possess suitable cavities for martins, no indications of their breeding elsewhere in such crevices were noted by us. Johnston and I questioned an elderly resident of the town about the birds, selecting for this inquiry a gentleman who had three martin houses in his back yard. He was familiar with the birds in question, estimating that they had frequented the Main Street area for 10 to 15 years, although he had never determined where the birds entered the building. Purple Martins nesting in bird houses are common in Ottawa as they are throughout eastern Kansas, and there is no noticeable scarcity of such man-made structures which might cause the birds to use natural cavities.

Allen and Nice (1952. *Amer. Midl. Nat.*, 47:614–616) summarize use of natural cavities for nesting by Purple Martins. In the eastern United States, use of nest sites other than those provided in martin houses has been rare in populated areas and has not been reported since the early part of the 20th century. Use of crevices in city buildings is known in the western United States (for example, Seattle, Washington), but previous to discovery of these Kansan birds, may not be recorded for the eastern half of the country. The use of natural cavities in sparsely populated areas farther east (such as in northern Minnesota and coastal Florida) doubtless still occurs.

The present observations were made while I was a research zoologist at the University of Kansas, Lawrence, Kansas.—John William Hardy, *Department of Zoology, University of California, Los Angeles 24, California, 25 July 1960.*

ORNITHOLOGICAL NEWS

The Wilson Ornithological Society now has a total of 1,561 members categorized as follows (with net gain over last year):

Active	1,233	(10)
Sustaining	144	(7)
Life	180	(12)
Patron	4	(0)

In addition, the Society is filling 228 subscriptions to *The Wilson Bulletin*, and receives 84 publications in exchange for the *Bulletin*.

The University of Georgia announces the awarding of the 1961 Stoddard-Sutton prize to Mr. Herbert W. Kale for his work on the breeding populations of Long-billed Marsh Wrens in Georgia salt marshes. The prize consists of a cash award accruing from the interest on the income received from the sale of the book "Georgia Birds" by T. H. Burleigh. The award honors Herbert L. Stoddard, eminent Georgia ornithologist and conservationist, and George M. Sutton, the artist who prepared the illustrations for the Georgia volume. The purpose of the award is to encourage a student (undergraduate or graduate) at the University who shows promise in original investigation in ornithology or wildlife ecology. Mr. Kale's work with the marsh wrens has also received national recognition in the form of a Frank M. Chapman award granted to aid his continuing work.

TO AUTHORS

All authors submitting manuscripts to *The Wilson Bulletin* are urged to read "Suggestions to Authors" on the inside back cover of this *Bulletin*. The "Style Manual for Biological Journals," which should be followed, was prepared by the Committee on Form and Style of the Conference of Biological Editors. The editorial boards of 78 biological journals have adopted this manual in whole or in part, so as to establish uniform standards in biological publications. The Style Manual was published on a non-profit-making basis. For orders, at $3.00 each, write to: Subscriptions, American Institute of Biological Sciences, 2000 P Street, NW, Washington 6, D. C., USA.

Dr. Jesse M. Shaver, for many years a bulwark of the Wilson Ornithological Society, died on 7 July 1961. Although Dr. Shaver had not been active in the affairs of the Society recently, he served it generously in various offices, culminating in its presidency, which he occupied from 1932 to 1934.

The Division of Biological and Medical Sciences of the National Science Foundation announces that the next closing date for receipt of basic research proposals in the life sciences is 15 January 1962. Proposals received prior to that date will be reviewed at the winter meetings of the Foundation's advisory panels and disposition will be made approximately four months following the closing date.

Inquiries should be addressed to the Biological and Medical Sciences Division, National Science Foundation, Washington 25, D. C.

In accordance with a decision of the 13th International Congress of Zoology, 1948, public notice is hereby given of the possible use by the International Commission on Zoological Nomenclature of its plenary powers in connection with the following cases, full

details of which will be found in the *Bulletin of Zoological Nomenclature*, Vol. 18, Part 3 published on 16 June 1961:

Validation of the generic name *Pnoepyga* Hodgson, 1844 (Aves). Z.N.(S.)1457;

Designation of a neotype for *Corvus benghalensis* Linnaeus, 1758 (Aves). Z.N.(S.)1465.

Anyone who wishes to comment on these two cases should do so in writing, and in duplicate, as soon as possible, and in any case before 16 December 1961. Each comment should bear the reference number of the case in question. Comments received early enough will be published in the *Bulletin of Zoological Nomenclature*. Those received too late for publication will, if received before 16 December 1961, be brought to the attention of the Commission at the time of commencement of voting.

Communications should be addressed as follows:

The Secretary
International Commission on Zoological Nomenclature
c/o British Museum (Natural History)
Cromwell Road
London, S.W. 7
England

The Museum of Comparative Zoology at Harvard College (Cambridge 38, Mass.) has just reprinted Volume III of the late J. L. Peters' "Check-list of Birds of the World." This volume, long out of print, lists the Columbidae and Psittacidae, and related families. It is available from the Museum for $10.00.

The only other volumes available are V ($7.00), VII ($6.00), and IX ($7.50), but if sufficient interest is indicated, additional volumes may be reprinted.

With the cooperation of specialists throughout the world, work is progressing rapidly toward completing the unpublished volumes. Volume XV, containing the Ploceidae, Sturnidae, Oriolidae, Dicruridae, Paradisaeidae, Corvidae, etc., is in press and should be ready early in 1962. The proposed sequence for the remaining volumes is: X, XII, XIV, XIII, XI, and VIII.

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STATUS AND PROBLEMS OF NORTH AMERICAN GROUSE

A Contribution from the Wilson Ornithological Society Conservation Committee

North American grouse fall into three overlapping groups: the ptarmigans—Willow (*Lagopus lagopus*), Rock (*L. mutus*), and White-tailed Ptarmigan (*L. leucurus*)—breeding on the arctic tundra, in the far northern brushlands, and above timberline on mountain tops; the forest dwellers, Blue (*Dendragapus obscurus*), Spruce (*Canachites canadensis*), and Ruffed Grouse (*Bonasa umbellus*); and lastly, the grouse of prairies and plains, of forest edges and openings, the Greater and Lesser Prairie Chickens (*Tympanuchus cupido* and *T. pallidicinctus*), Sharp-tailed (*Pedioecetes phasianellus*) and Sage Grouse (*Centrocercus urophasianus*). Each group, by the nature of its environment, has been affected differently by the pressures of modern civilization. As a result, population status and the problems of survival differ more from group to group than from species to species within a group.

In this report we will give most attention to those species whose status is least secure. For generalized maps of the distribution of all species except Willow and Rock Ptarmigan, see Aldrich and Duvall (1955).

The ptarmigans are a widespread and successful group. As sources of human food, as distinct from sport hunting, it is likely that since prehistoric times the Willow and Rock Ptarmigan have had greater importance than any other grouse. Because their range is generally thinly populated by man and little changed by his activities, ptarmigan have not been much affected by this levy on their numbers. Sport hunting over their range as a whole has not been a large factor, but hunting is bound to increase in limited areas such as parts of Alaska and those sections in northern Canada near the increasing number of mining centers.

Newfoundland is a special case. There are no other upland game birds there in huntable numbers, although Ruffed and Spruce Grouse have recently been introduced in small numbers. The ptarmigans, and especially the larger and more accessible Willow Ptarmigan, are highly prized for hunting. Willow Ptarmigan appeared to be decreasing at an alarming rate in the early 1950's, especially on the Avalon Peninsula (Wildlife Management Institute, 1955), but by 1960 the population was high again (A. T. Bergerud, 1961, verbal). Studies now in progress may help to explain such fluctuations and to lead to a management program. It now appears that fire plays an important role in the ecology of Willow Ptarmigan: fire encourages *Vaccinium*, a valuable source of food, while the absence of fire allows the successional replacement of *Vaccinium* by *Kalmia*, which has little or no value for ptarmigan (Bergerud, ibid.).

The White-tailed Ptarmigan is the only species resident in the United States. Much of its high mountain range is now, and is likely to remain, relatively undisturbed, and hunting is so difficult that it is not often attempted. In a few places, however, grazing of alpine meadows may have seriously reduced and even eliminated ptarmigan populations. Possible examples occur in Montana in the Whitefish, Bitterroot, Flint Creek, and Anaconda-Pintlar Ranges, and in the Beartooth Plateau-Absaroka Range complex. Ptarmigan are gone from these places where old records—unfortunately not supported by specimens—suggest that they formerly occurred (R. S. Hoffman, 1960, letter). Grazing may have affected ptarmigan habitat in some areas in Washington (F. Zwickel, 1960, letter). Grazing drove ptarmigan almost to extirpation in the mountains of northern New Mexico many years ago (Ligon, 1927); they are now seen occasionally only on Costilla Peak, apparently as stragglers from nearby Colorado (J. S. Ligon, 1960, letter).

The Blue Grouse is a thriving species of the Douglas fir (*Pseudotsuga*) region of the far West (Beer, 1943). It is one of the major game birds over much of its range, as in British Columbia, western Alberta, Washington, Oregon, California, Idaho, Montana, Colorado, and Wyoming. In southeastern Alaska it is seldom hunted because of the difficult terrain in which it lives (R. B. Weeden, 1960, letter). In Utah, Nevada, Arizona, and New Mexico it is much less abundant than in the more northern parts of its range. Unlike most mountain dwellers, the Blue Grouse breeds at lower elevations, often as far down as the foothills, and moves to the mountain tops just below timberline for the winter. Most observers speak of the upward movement as beginning in summer (e. g., Wing, 1947; Hoffman, 1956), and Marshall (1946) relates it to the progressively later ripening of fruit at higher altitudes; Bendell (1955) dates the movement on Vancouver Island as beginning as early as late April for cocks and July for hens and young. As a result of this movement, the more easily hunted lower slopes hold only a part of the population by the time hunting seasons normally open, and a large part of the population is by then dispersed over the larger and less accessible winter range. In at least one area in California this upward movement and dispersal does not occur (Hoffman, 1956).

Lumbering and fire in the heavily forested coastal region have increased the primeval breeding range of the Blue Grouse, and the wintering range has been little affected. The net result has been an increase in the Blue Grouse population (J. F. Bendell, 1960, letter). In some places, for example Vancouver Island (Hatter et al., 1956) and parts of western Washington (F. Zwickel, 1960, letter), forest succession after cutting has already gone well beyond the early stages which are best for Blue Grouse. However, future cuttings will probably sustain a long-continuing population at a moderately high level. These same successional factors are also at work in the southern and more eastern parts of the range, but livestock grazing on the lower slopes presents a potential, and in places an actual, threat to breeding habitat. The problem is already recognized. For example, in Washington, B. L. Lauckhart (1960, letter) writes: "Our best blue grouse populations have developed on our department-owned big game winter ranges, where we have purchased the land and eliminated grazing of domestic livestock"; I. O. Buss (1960, letter) adds: "Although blue grouse, ruffed grouse, and Franklin grouse enjoy very good to excellent habitat conditions (status) today, it is entirely possible that the extensive ranges of these birds will be affected significantly when agricultural (particularly grazing) advancement infringes on the breeding range of the foothills of the mountains." Overgrazing appears to be reducing the breeding range of the Blue Grouse in Idaho, where the population has been on the decline for the past two or three decades (E. G. Bizeau, 1960, letter). Montana is currently measuring the effects of grazing on both Blue and Sharp-tailed Grouse (R. L. Eng, 1960, letter).

The Spruce Grouse is one of the most widely distributed North American grouse and one of the least understood. It is generally considered to be a bird of deep climax coniferous forests and swamps, but in parts of Ontario, Michigan, and Minnesota it is found in fair numbers in natural jack pine (*Pinus Banksiana*) stands. J. Hatter (1960, letter) writes of British Columbia: "It is my feeling that a certain amount of fire with the resultant openings in the climax forest does improve conditions for Spruce Grouse." It has the largest range of all grouse in Alaska, where it is a major game bird (Buckley, 1954). It is abundant enough to be hunted in Washington, Idaho, and Montana, although hunting pressure is generally light. In contrast, it occurs infrequently to rarely over much of the eastern part of its range. Scarcity is by no means caused only by the advance of civilization, for there appear to be regions of scarcity and of abundance in wilderness country as well. This is not to say that it has not been affected by civilization, for cer-

tainly there has been much loss of habitat and some harassment of remaining populations along the southern part of the eastern half or more of the geographic range. In Ontario south of Lake Nipissing, for example, the species has disappeared from all but a few localities (Lumsden, 1960, letter). Considering the vast range which it still occupies, one cannot call the Spruce Grouse a threatened species; nevertheless, this may be cold comfort for ornithologists in those eastern states where the bird is now rare. A full-scale study of the ecology and population dynamics of the Spruce Grouse is clearly needed, but we do not know of a single current example.

The Ruffed Grouse is the best known of the forest grouse, and the one that lives in closest association with civilized man. Where topography and climate have favored the large-scale conversion of forest to plowland, the Ruffed Grouse has been wholly wiped out over considerable areas, or reduced to small colonies in scattered farm woodlots. This happened as early as 1752 in parts of Pennsylvania (Bartram, quoted in Bump et al., 1947), and has been most conspicuously true in the southern and eastern parts of the range in Ohio, Indiana, Illinois, Kentucky, Tennessee, Iowa, Missouri, and in the southern parts of Ontario, Michigan, Wisconsin, and Minnesota. It has wholly or virtually disappeared from its once fairly large range in Arkansas, and from the smaller areas of former range in Alabama, Georgia, Nebraska, and Kansas (Aldrich and Duvall, 1955). Nor has the process of habitat destruction come to an end. In Ohio about 50,000 acres of agricultural land are currently lost to suburbs and industry each year, with woodlots and other timbered areas being cleared at a corresponding rate as replacement acres for agriculture (T. J. Peterle, 1960, letter).

However, where large stretches of forest have been partially broken up by the introduction of farms, or where such farms have been abandoned and the fields allowed to revert naturally to forest, Ruffed Grouse have been considerably increased over their primeval numbers. Second growth after fires and lumbering have similarly benefited Ruffed Grouse over a geographically enormous area, both by producing interspersion in former monotypes and by turning forest succession back to the younger stages which are far more productive of Ruffed Grouse than mature stands are.

Both destruction and improvement of Ruffed Grouse range are constantly going on, and sometimes the same piece of ground has been affected more than once in historic times. Northern Wisconsin, for example, became much better Ruffed Grouse habitat when the old forests were logged off and replaced by younger stands. Today, however, much of the second-growth forest has passed beyond optimum conditions for Ruffed Grouse and the total population is probably now, or certainly soon will be, smaller than it was at its greatest. And in the earlier settled parts of the country like New England, the second growth itself has been cut, and cut again, with corresponding changes in grouse abundance.

The Ruffed Grouse is superb for sport hunting. On the basis of its wide distribution (coast to coast), total numbers (well into the millions), and annual kill (millions), it takes first place among all the grouse as a sporting bird. Furthermore, habitat management is now practiced, as with other game species in many areas where the population is not endangered, to make a fair population larger in order to improve hunting. There is already available a considerable body of technical knowledge. One of the most important problems still to be solved is how to fit Ruffed Grouse management into forest management. Silvicultural methods are changing and already are very different from those that produced such abundant crops of grouse and deer in the past. Large pine plantations, often established at the expense of vitally important openings, are virtually worthless for wildlife, but are an increasingly large part of modern forestry programs. Group-selection-

cutting is aimed at maintaining an essentially closed canopy, and by that very fact tends to discourage both the mixture of plant species and of age classes which Ruffed Grouse must have.

It is not simple to manage a forest so as to produce sustained crops of both timber and wildlife. Wildlife is most abundant in young forests and in forests with a mixture of age classes most of which are young. It follows that almost any cutting will benefit wildlife sooner or later and in some degree. Cuttings are sometimes planned deliberately to benefit deer and Ruffed Grouse. But such glittering generalities as "the best forest management is the best game management," while sometimes true, do an enormous disservice by glossing over the ecological complications and outright contradictions which can be overcome only by direct and forthright action.

It is the grouse of open country and the forest edge—Greater and Lesser Prairie Chickens, Sage Grouse, and the three southern races of the Sharp-tailed Grouse—that are faring worst in modern times.

The Heath Hen, the eastern race of the prairie chicken, became extinct in 1932. The Attwater's Prairie Chicken, the southern race and the southernmost grouse in all the world, is on the verge of extinction. Once common on the coastal prairies of Texas and Louisiana, it is now restricted to scattered, isolated colonies in parts of 11 counties in Texas (P. B. Uzzell, 1960, letter). We estimate the total population at *less than one per cent of its former numbers.* There is no mystery about the cause of this decline: it is the conversion of prairie sod to rice fields and other crops, and the overgrazing of virtually all the remaining grassland. Time is running out. If the Attwater's Prairie Chicken is not to follow the Heath Hen, action will have to be taken at once. This is not just a question of protection against hunting: there has been no open season since 1937, yet the population continues to shrink. Neither is it a question of restocking, for there is no stock to be had; and if there were, could it be expected to fare any better than the wild birds already present? The solution lies in habitat management—in giving back, in some small measure, what has been taken away. If the Attwater's Prairie Chicken is finally lost it will not be through lack of knowledge of what to do, but through lack of doing. What needs to be done has been known for 20 years (Lehmann, 1941).

The Greater Prairie Chicken, with a much larger geographic range, is in better case than the Attwater's, but over much of its range the story is the same. Most of the original range has been plowed or grazed out of existence. Most of the acquired range to the north and west has been destroyed and fragmented through the same causes, as well as by the return of the forest to the new range in the Michigan and Wisconsin cutover. Thus, Greater Prairie Chickens are now gone from their primeval range in Ohio, Kentucky, Arkansas, and Texas. They occur now in Iowa only as occasional stragglers in the northeast and southwest corners (M. E. Stempel, 1960, letter). There are still prairie chickens in Indiana, but the *total population in the spring of 1960 is estimated at 98 birds* (W. B. Barnes, 1960, letter); in Illinois, where there are perhaps 100 small colonies in 25 counties (R. E. Yeatter, 1960, letter); in Missouri, mainly southwest of the Missouri River (D. M. Christisen, 1960, letter); and in eastern Kansas and eastern Oklahoma. Within the acquired range, which once was larger than the presettlement range, prairie chickens remain in about 16 counties in the northeastern Lower Peninsula of Michigan (G. A. Ammann, 1960, letter); in about 16 counties in central and northern Wisconsin; in about 500 square miles in northwest Minnesota (A. B. Erickson, 1960, letter; Farmes, Erickson, and Stenlund, 1960); in a few areas scattered throughout approximately 5,000 square miles of east central North Dakota (M. D. Johnson, 1960, letter); in South Dakota primarily in about 20 per cent (2,000 square miles) of a block of seven counties, plus a few

small outlying colonies (D. R. West, 1960, letter); in a broad band totaling some thousands of square miles along the eastern and southern edges of the central Nebraska Sandhills and to some extent within the Sandhills (L. L. Mohler, 1956, letter; M. D. Schwilling, 1960, letter); and in the northeast corner of Colorado, mainly in Yuma County (W. W. Sandfort, 1960, letter). The "millions of prairie chickens in Canada" that one hears about are sharp-tails. It is possible that a few true prairie chickens still persist near the lakes of central Alberta (M. C. Hammond, 1960, letter). One—*one*—was seen in Saskatchewan in 1959 by the one man who cannot be challenged, Roger Tory Peterson (verbal). Manitoba has a few reports of single birds within the last few years but "we do not know of one single flock to date" (R. E. McWhorter, 1960, letter). Ontario's one remaining colony, on Manitoulin Island, is probably disappearing, due to the invasion of sharp-tails (H. C. Lumsden, 1960, letter).

While complete and precise figures are not available, it is not far off to say that about 85 per cent of the presettlement range of the Greater Prairie Chicken has been expropriated and destroyed by being put to other uses. Perhaps the acquired range has fared a little better, but the Greater Prairie Chicken now occupies a range that is no more than about 10 to 20 per cent of the range at the time of its maximum extent. Populations are low over much of the present range, and reports from most areas indicate that habitat continues to disappear and the prairie chickens with it.

There are, however, encouraging signs at long last. Oklahoma is a particularly bright spot. The Greater Prairie Chicken once occurred there over the eastern two-thirds of the state. From about 1900 to 1925–1932 the habitat was severely damaged by plowing and overgrazing, finally accentuated by drought. The population dropped to the lowest level known (estimated at a few thousand birds in 1925) and the occupied range shrank to about 5,000 square miles in the northeast part of the state (Duck and Fletcher, 1945). The drought ended in the 1930's and the grass came back; more important—for drought is a recurring thing—there has been a change in land use which is favorable to prairie chickens. Many ranchers have learned that their lands are not suited to cultivation but will yield the greatest profit as grazing land. Further, range management is changing toward less intensive grazing—"take half and leave half"—again because this is best from the strict economic viewpoint. Under such a grazing regime, prairie chickens also thrive. Not only has the population on the residual range increased, but substantial areas elsewhere in Oklahoma have "come back" to the point where they can again support prairie chickens. A total of 830,000 acres has already been examined and found suitable, and considerably more is probably suitable but not yet appraised. A project under the direction of Karl F. Jacobs has transplanted 586 wild-trapped birds to restoration areas in seven counties over the last five years, in order to re-establish prairie chickens without waiting for natural spread to do the job. The transplantings have in most cases been successful and will be continued (Jacobs, 1959 and letter, 1960).

Kansas and Nebraska are experiencing a similar improvement in the condition of grasslands, and show encouraging gains in prairie chicken populations (D. C. Coleman, 1960, and M. D. Schwilling, 1960, letters). Habitat improvement is less general in the north, however. South Dakota had excellent production in 1958 but a very poor year in 1959 (D. R. West, 1960, letter), while in North Dakota the grasslands in the prairie chicken range are "still depleted" and the small colonies still present are "barely holding their own" (A. T. Klett, 1960, letter).

The importance of the changing trend in range management for cattle cannot be overemphasized. If the scheme of "take half and leave half" is widely adopted and made permanent, the prairie chicken may change from an endangered species to a major

game bird in the western parts of its range. The same trend in grassland management strongly implies possible betterment in some areas for the Lesser Prairie Chicken, Sharp-tailed Grouse, Sage Grouse, and Blue Grouse as well as many other kinds of wildlife.

Farther east there are also encouraging developments for prairie chickens. Prairie chicken management is primarily land management; before one can manage land one must have some control over it. A movement to buy land for prairie chickens has started and is gaining momentum. The first piece was bought in Indiana in 1945, when 640 acres were bought with funds raised by the Izaak Walton League plus matching monies from the Pittman-Roberston program. Wisconsin's scatter-pattern plan (Hamerstrom, Mattson, and Hamerstrom, 1957) is moving ahead: from 1954 through 1960 a total of 1,885 acres on the Buena Vista Marsh has been privately purchased and leased to the state (Olson, 1961). These acres were bought by individuals, by the Prairie Chicken Foundation, the Wisconsin Conservation League, and the Wisconsin Society for Ornithology. The state of Wisconsin has bought 560 acres on the adjoining Leola Marsh. Michigan has started scatter-pattern purchase on its Missaukee County area (Ammann, 1957:168–9 and letter, 1960). Missouri started a similar program in 1959 by buying 1,440 acres of native prairie in St. Clair County, to which a series of smaller parcels will be added (C. W. Schwartz, 1960, letter). Illinois is currently raising money for land purchase through its Prairie Chicken Foundation, composed of the Illinois Audubon Society, Illinois Federation of Sportsmen's Clubs, Illinois Division of the Izaak Walton League, and the Illinois Chapter of the Nature Conservancy (R. E. Yeatter, 1960, letter). Twenty areas in northwestern Minnesota, totaling 20,000 acres, have been bought by the state as part of its wetlands program; most were bought primarily for waterfowl but all have prairie chickens on them (A. B. Erickson, 1960, letter). The Fish and Wildlife Service, on its refuges in Nebraska and the Dakotas, has recently started a prairie chicken–sharp-tail management program embracing annual display ground census, attempts to restock prairie chickens on the Sand Lake Refuge (South Dakota), and—most important—a determined effort to modify the pattern of hay mowing and to cut back grazing by permittee livestock (H. K. Nelson, 1960, letter; M. C. Hammond, 1960, letter). The Service is under pressure in some quarters to relax its mowing and grazing restrictions again and is to be commended for continuing its attempt to replenish the sadly depleted stock of prairie chickens on federal refuge lands. Both Illinois and Wyoming have tried introductions of wild stock.

The Lesser Prairie Chicken has a relatively small, horseshoe-shaped range along the east edge of New Mexico, across the panhandle of Oklahoma, the southeastern tip of Colorado, southwestern Kansas, and along both sides of the boundary between western Oklahoma and northeastern Texas. This is primarily grazing country, with little cropland. Overgrazing has been a serious problem, especially in times of drought. The Lesser Prairie Chicken has survived two severe droughts in the last 30 years.

In Kansas the Lesser Prairie Chicken nearly disappeared during the drought of the 1930's but showed considerable recovery by the 1950's (Baker, 1953; Schwilling, 1955); their numbers still seem to be increasing somewhat (D. C. Coleman, 1960, letter). Booming ground counts in Oklahoma (Copelin, 1959 and unpublished reports and letters 1955–1960) show increases from 1957 through 1959 but were still only about half of the high count for the late 1930's. Similar counts in New Mexico show an increase from 1953 through 1958 (L. G. Frary, 1955–1958, unpublished reports). Booming ground counts in Texas show a drop of more than 50 per cent as between 1942 and 1953 on two study areas. Most of this was attributed to the drought of 1952–53. Both areas have been censused each year since 1953, and although one of the two has shown some recovery, neither has reached 50 per cent of the 1942 count (A. S. Jackson, 1960, letter and unpublished reports).

Although Lesser Prairie Chickens are currently on the increase, their range and total numbers are nevertheless much reduced over presettlement days. They are particularly vulnerable at two points. Since they depend on medium and tall grasses in a region of low rainfall, their habitat is very sensitive to overgrazing. Furthermore, low shrubs, particularly shinnery oak (*Quercus havardii*) and sand sagebrush (*Artemesia filifolia*), which are also highly important parts of the habitat, are increasingly being killed with herbicides in the interest of pasture improvement. Although the trend toward moderation in grazing holds a great deal of promise, it is likely that many ranch owners who are progressive enough to adopt the new plan of grazing management would also practice brush removal.

New Mexico was the first to recognize—at least to the point of doing something about it—that the key to the welfare of the Lesser Prairie Chicken lies in the control of grazing. From 1938 to 1951, the state bought 22,844 acres and leased 800 acres for a total of 23,644 acres in 19 tracts, from which livestock has been fenced out. Grass recovery has been slow because of drought and severe damage by overgrazing in the past; nevertheless, these areas are considered to be of major importance in New Mexico's program of Lesser Prairie Chicken management. The U. S. Forest Service administers an area of about 107,000 acres in Morton County, Kansas. This is one of the recently established National Grasslands (U. S. Forest Service, 1960), and it has great potential for Lesser Prairie Chickens. Grazing has already been restricted on National Grasslands in southeastern Colorado (W. W. Sandfort, 1960, letter). On these areas and on New Mexico's Lesser Prairie Chicken restoration areas, where public ownership guarantees land control, it should be possible to work out the details of land management needed for the species, especially details related to tolerable limits of grazing, brush removal, burning, amount of cultivation, if any, which might be beneficial, and to carry forward a long-term gobbling ground census, etc.

The situation for sharp-tails is more complex. Little is known about the three northern races, *phasianus*, *caurus*, and *kennicottii*. It is generally taken for granted that they are getting along all right, for their range has not yet been much influenced by civilization. However, the exploitation of the far north has begun, and the northern birds will be less and less isolated as time goes on.

The southern races already feel the pinch. Two of them, *campestris* and *columbianus*, are in serious trouble. Sharp-tails of the prairie race, *campestris*, are already long gone from Illinois, Iowa, southern Wisconsin, and southern Minnesota. They are still abundant in parts of southwestern Ontario and in the parklands of southern Manitoba and east central Saskatchewan, but in northern Michigan, Minnesota, and Wisconsin—especially Wisconsin—they are rapidly being crowded out of existence. In this part of their earlier range they were found in bogs, blowdowns, and burns within the forest boundary, and in the extensive zone of brushland (also the result of fire) which lay along the edge between forest and prairie. Lumbering followed by fire in the slashings, and pioneer farming in the cutover, enormously expanded the primeval range in all three states for a time; but fire protection, natural forest succession, pine plantations, and modern clean farming within the successful farm communities in the cutover, have all played their part in taking away the new range until there is far less range than there was in the first place. Wisconsin has now planted to pine most of the primeval barrens as well as the abandoned farm fields, and effectively prevents the creation of new openings by its exceptionally efficient fire protection system (Hamerstrom, Hamerstrom, and Mattson, 1952). Michigan will have sharp-tails for a longer time and Minnesota longer still,

but without deliberate sharp-tail management all three states will fairly soon find sharp-tails on the rare bird list.

There is much still to be learned about the details of sharp-tail management, but in both Michigan and Wisconsin real progress has been made. The main difficulties in the way of a vigorous program are two: First, sharp-tail openings in the forest, particularly old fields and burns, are often the easiest areas to machine-plant to conifers. Large areas of monotypic plantations are regarded with increasing suspicion by foresters themselves. Nevertheless, in the competition for forest openings—a competition in which subsidies for tree planting play a very important part—sharp-tails are still coming out a poor second best. Secondly, sharp-tail populations are strongly cyclic, and a great many hunters lose interest when populations are low and hard to hunt; this, of course, discourages administrators in charge of public programs. Nevertheless, some lands are now being managed for sharp-tails, especially in Michigan (Ammann, 1957) and Wisconsin (Newman, 1959).

The western race *columbianus* has been hardest hit of all. It is gone from California (A. S. Leopold, 1960, letter), occurs in one small area (if it is still there) in New Mexico, is rare in Utah (about 1,500 birds—J. B. Low, 1960, letter), Nevada, and Oregon; rare or uncommon in Idaho and Washington except for a few counties in which it is still abundant enough to be hunted; and it is sometimes locally fairly abundant but is generally not common in parts of western Colorado, western Wyoming, and extreme western Montana. The only sizable populations left are in British Columbia, particularly in the Peace River, Vanderhoof, and Prince George regions, where land clearing and grain growing are still on a limited enough scale to have benefitted sharp-tails (Hatter et al., 1956). Overgrazing and intensive cultivation have been the primary causes of the decline of this race: see, for example, Buss and Dziedzic (1955). It is not likely that the rich wheatlands of the West will ever be restored to sharp-tail habitat, but changes in grazing practices do offer some hope.

The plains sharp-tail, *jamesi*, has the largest range of all six races and is by all odds the most successful of the three southern sharp-tails. While it has lost ground in the eastern and southernmost parts of its range—in the eastern parts of North Dakota, South Dakota, and Nebraska, and in all its former range in northwest Kansas—and while it has been thinned out over much of its range by overgrazing and cultivation, particularly wheat farming, it still occurs in impressive numbers over large parts of the Dakotas, Nebraska, and eastern Montana. There are fair to good populations in parts of northeastern Colorado and northern Wyoming. In the Prairie Provinces of Canada it reaches numbers little short of fabulous at the highs of the population cycle. Within the limits set by land use (and with a cautious hedge to allow for the influence of the unexplained grouse cycle), reproductive success appears to be high in cool-moist summers and low in hot-dry summers, with two to three cool-moist summers to be expected in each decade in South Dakota, for example (D. R. West, 1960, letter).

There is little deliberate management of the plains sharp-tail other than the regulation of hunting. Actually, little management is needed over the range as a whole, because this grouse is maintaining itself well and lives in a region of rather low human population and hunting pressure. Such general wildlife management practices as the planting of shelterbelts of trees and shrubs in the wheat country, the development of small water areas and their attendant variety in vegetation, and provision of winter food in some areas in the north, all undoubtedly benefit sharp-tails. Moderation of grazing pressure in rangelands would have a wider effect than any management applied directly and specifically for sharp-tails. The most conspicuous example of land man-

agement for this race is the program of grassland management which has been started by the Fish and Wildlife Service on the waterfowl refuges in the Dakotas and Nebraska, already mentioned in the section on the Greater Prairie Chicken.

The Sage Grouse has shown dramatic and not fully understood changes in abundance. It was once the leading upland game bird in most western states, but by 1937 had become so scarce over much of its range that it seemed close to extirpation (Patterson, 1950, 1952). Today it is again abundant enough to be a major game bird in a number of states, although both total range and total numbers are much reduced. Thus, the estimated kill in 1959 was 43,811 in Wyoming (D. A. Johnson, 1960, letter), 23,300 in Idaho (E. G. Bizeau, 1960, letter), 23,200 in Montana (R. L. Eng, 1960, letter), 17,304 in Oregon (R. U. Mace, 1960, letter), 15,335 in Colorado (G. E. Rogers, 1961, letter), and 11,738 in Nevada (C. W. Crunden, 1961, letter). By contrast, California hunts Sage Grouse in two to five counties and kills about 2,000–3,000 annually (California Department Fish and Game, 1958); Washington kills only about 2,000 annually (B. L. Lauckhart, 1960, letter); and the estimated kill in 1959 in Utah was "over 1,800" (C. M. Greenhalgh, 1960, letter). The Sage Grouse comes east in small numbers as far as the westernmost counties of North and South Dakota and Nebraska, and its range extends north into a narrow strip along the southern edges of southwestern Saskatchewan and southeastern Alberta. The species disappeared earlier from New Mexico and British Columbia. New Mexico successfully reintroduced Sage Grouse on a small scale by transplantings, and British Columbia is now trying to restock in the same manner.

Sage Grouse are closely dependent upon sagebrush (*Artemesia* spp.) throughout the year, and wholly so in winter. Ranchers consider sagebrush undesirable. They would rather have more grass for their sheep and cattle. Sagebrush eradication programs, subsidized with federal money, are "cleaning up" an ever increasing area and this, added to the overgrazing which has been chronic on much of the remaining Sage Grouse range, seriously affects Sage Grouse populations in many states.

Most of the states within the range of the species have had research studies in progress at one time or another, and several do at the present time. The most informative was that of Patterson (1952) who concluded that: (1) the largest Sage Grouse populations are in those states with the lowest human populations, (2) overgrazing by domestic livestock was the most important factor in the great reduction in numbers of Sage Grouse and other game in the early 1900's, (3) programs to eradicate sagebrush in order to improve grasslands for grazing are ecologically unsound and damage the range for Sage Grouse and other wildlife, and for domestic livestock as well, in the long run, and that (4) reclamation of sagebrush lands for agricultural purposes is the most serious threat to the welfare of Sage Grouse populations.

There are state or federal restoration areas for Sage Grouse in several states, for example, Washington, Oregon, Nevada, and Utah (and probably others). Other management measures which have been tried include the development of water supplies, transplanting of wild stock to speed re-establishment where natural spread was slow, and, of course, regulation of hunting. It has been pointed out in no uncertain terms, however, that regulation of permittee grazing on the public lands of the West is the governing factor (Patterson, 1952). Just as abuses of grazing on public lands caused the great decline of the early 1900's, so did later readjustments toward more reasonable livestock numbers bring about the increase in Sage Grouse which led to the much improved population levels of the present day. The implications for the future management of the Sage Grouse are abundantly clear.

In fact, the tetraonids as a group illustrate remarkably well a fundamental ecological

principle: that the welfare of any species is basically determined by the condition of its habitat. Modern man is now one of the major forces, often the most important, in shaping habitats. Ultimately, the preservation or destruction of many species is in our hands.

ACKNOWLEDGMENTS

This report is largely based on material not yet published. We are glad to acknowledge the help so generously given by 42 wildlifers in other states and in Canada and have identified them in the text. In almost every case the contribution of each man is greater than the one or two points at which his name is mentioned, for most of them sent information on all grouse in their respective states or provinces. Our thanks also to R. A. McCabe, T. G. Scott, and R. E. Yeatter for critically reading the manuscript.

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ORNITHOLOGICAL LITERATURE

BIRD PORTRAITS IN COLOR. Text by Thomas S. Roberts. Revised by Walter J. Breckenridge, Dwain W. Warner, and Robert W. Dickerman. University of Minnesota Press, Minneapolis, 1960: 8½ × 11¼ in., vi + 105 unnumbered pp., 92 col. pls. $5.95.

"Bird Portraits in Color" was in constant demand from the day it was published in 1934. Soon out of print, it was reprinted in 1936 and went out of print again in 1944. Since that time any copy for sale by book dealers commanded a price far exceeding the figure ($3.50 in hard covers) at which it was originally listed. This bit of history bears evidence enough of the book's usefulness. Now, fortunately, "Portraits" has been reprinted a second time and again at a modest price, in this instance through the generous financial support of an admirer of its author, the late Dr. Thomas S. Roberts.

"Portraits" contains all of the 92 plates (by six artists) from Roberts' "The Birds of Minnesota" (University of Minnesota Press, 1932). Depicted are 295 bird species, representing nearly all the species in the United States north of Kentucky and Missouri and east of the Rocky Mountains. Opposite each plate is a page of text, giving information on size, range, plumages and molts, songs and calls, nests, and eggs of the species shown. All the material has been brought up to date by the three revisers. The species on the plates are indexed in the back of the book. Nomenclature follows the fifth edition (1957) of "The AOU Check-list," although in the case of common names, not always strictly. Hyphens are used in many names (e.g., "Golden-eye," "Yellow-legs," etc.), while "Wood Pewee" and "Phoebe" are given for the names of the Eastern Wood Pewee and Eastern Phoebe.

The reprinting of the color plates is exceedingly good; almost all have the same brightness, richness of color, and clarity that they have in "The Birds of Minnesota."—OLIN SEWALL PETTINGILL, JR.

ICELAND SUMMER: ADVENTURES OF A BIRD PAINTER. By George Miksch Sutton. Illustrated by the author. University of Oklahoma Press, Norman, 1961: 5¾ × 9¼ in., xviii + 253 pp., 17 full-page illus. (1 col.). $5.95.

It is the irrepressible spirit of youth in George Miksch Sutton which makes all of his books so fascinating. That spirit, coupled with his great knowledge of birds, his wonderful sense of adventure, his never-satisfied curiosity, and above all, his extraordinary ability to paint, all make "Iceland Summer" a most attractive and interesting book.

Dr. Sutton has for a good part of his life been fascinated with the idea of writing a book about arctic birds. Toward this end he has traveled widely in the northern parts of the western hemisphere and he has written much about them. He has not, however, had an opportunity to work in the Old World Arctic, especially Siberia. Therefore, the possibility of a trip to Iceland with Olin Sewall Pettingill, Jr., and his wife seemed the perfect 1958-step in the right direction.

While there he fell in love with the people and the country. He was able to paint a good deal, mostly from live bird models, and—being Dr. Sutton—found all manner of adventures to give zest to the summer project. All of these combined to make "Iceland Summer" a most profitable and entertaining book. It fits into a singular niche in that it is most informative, a pleasure to read, and it offers much of beauty for the eyes to behold. Unlike the usual specialist moving into a new country, Dr. Sutton seems to notice just about everything around him.

He visited most of the important representative habitats, thus his account is well-rounded

and quite representative. Mývatn receives special attention since (next to Lake Baikal) it is the most interesting waterfowl lake in the world. Like most ornithologists who have visited Iceland, his emphasis is on the northern, western, and southern (essentially coastal) areas, and, of course, the islands. This is natural because of the available transportation—all stemming from Reykjavík in the southwest corner of the island.

The Icelandic people as a whole are very fond of birds, and it is easy to understand their cordiality to a person like Dr. Sutton who came there full of enthusiasm for his project—for him a business of such transcending interest that nothing seemed to stand in his way. Little wonder then that he had such superb cooperation on all sides. His pleasure began almost at once upon his arrival when he found that many of the special birds he wished to study were present right in the heart of Reykjavík.

He went to great trouble to paint from live specimens rather than follow the easy road of the "deep freeze" technique for keeping specimens. Especially fine among his portraits is that of the Icelandic Falcon which the Icelanders subsequently used on their 25 krónur stamp. Notable also are the paintings of young birds, among the best he has ever done. Anyone who has worked with young birds will especially appreciate the effort and patience it must have taken to obtain and keep them for painting.

Adventure writers would do well to read Dr. Sutton's account of his fall into a ditch while getting into position to study a wagtail's nest. This is dramatically told. For any ornithologist the reading of "Iceland Summer" will be a profitable experience, in fact anyone interested in Icelandic birds will find this book a must.—Rosario Mazzeo.

Birds of Hawaii. By George C. Munro. New edition. Charles E. Tuttle Company, Rutland, Vermont, and Tokyo, Japan, 1961: 6½ × 9⅛ in., 192 pp., 20 col. pls. by Y. Oda, 19 photos. $4.50.

Munro's "Birds of Hawaii" was first published in 1944. (See the review by Dean Amadon in *The Auk*, vol. 61, p. 658, 1944.) Not long thereafter copies became difficult to obtain, owing to loss by fire of most of the stock. This new edition is a photocopy of the original, except for the title page and its reverse side plus the last two pages which give corrections and changes in scientific nomenclature. The color plates, showing over 150 birds, were reproduced by offset from the 1944 book itself. This was the only practical method available to the publishers since the original paintings, as well as the transparencies made from them, had been lost. Despite this unusual procedure, the new plates are remarkably faithful in clarity and color quality.

Besides having good color plates, the new edition has an eye-catching jacket, sturdy binding, and paper of good quality on which printing and halftones are commendably clear. No less attractive than the over-all production is the book's low price.—Olin Sewall Pettingill, Jr.

Birds of North Carolina. By Thomas Gilbert Pearson, Clement Samuel Brimley, and Herbert Hutchinson Brimley. Revised by David L. Wray and Harry T. Davis. North Carolina Department of Agriculture, State Museum Division, Raleigh, 1959: 6½ × 9½ in., xxviii + 434 pp., 47 pls. (24 col.), 97 text figs. $5.00.

This revision of the 1942 edition with the same title contains the following major changes: The deletion of the full-page portraits of the authors; the addition of a preface by the revisers, a map of the state's life zones with descriptive text, accounts of 12 species

new to the state, footnotes after most of the other species accounts, a new index replacing the old, and 10 plates (four in color) from Roger Tory Peterson's eastern "Field Guide" (1947 edition).

The revisers did not touch the species accounts, even to amend statements of information which, in the light of recent knowledge, are outmoded. Josselyn Van Tyne, in reviewing the 1942 edition (see *The Wilson Bulletin*, vol. 54, p. 204, 1942) called attention to some of the statements (e.g., the implication that only one nest of the Connecticut Warbler has ever been found; the reference to the cowbirds as "social outcasts" and their young as "selfish"), but they have been retained verbatim. Though the revisers remark (p. xxvi) that the "classification in this edition is changed to conform to the latest A.O.U. Check List," the classification is nevertheless about the same as in the 1942 edition. Subspecies and species are given equal treatment. Little attempt has been made to bring either the technical or vernacular names of species in line with those in the 1957 Check-list. The footnotes to the species accounts are mainly listings or summations of sight observations since 1942. As most of them do not include years and authorities, they are valueless as distributional data. (The records in the untouched species accounts are nearly always meticulously documented.) The bibliography has no entry since 1942.

A few of the plates, including the additional Peterson plates, have been reproduced fairly well, but others have been handled atrociously. The color plates are in many cases badly off register and/or peculiarly granulated, while the black-and-white plates, as well as the majority of text figures, are conspicuously fogged.

Ordinarily the revision of a useful state bird book is sure to reactivate local interest, but this one, even though attractively priced, is so poorly conceived and executed as to impair any such result. Certainly it does not do justice to recent advances in ornithology, either in North Carolina or elsewhere.—Olin Sewall Pettingill, Jr.

Louisiana Birds. By George H. Lowery, Jr. Rev. 2nd Ed. Illustrated by Robert E. Tucker. Louisiana State University Press, Baton Rouge, 1960: 6⅛ × 8¾ in., xxxiv + 567 pp., 40 col. pls., 83 photos (1 col.), 135 figs. and many numbered line drawings. $7.50.

A steady demand for "Louisiana Birds" since its publication in 1955 soon encouraged author and publisher to bring out this revised second edition. (For a review of the first edition, see *The Wilson Bulletin*, vol. 68, pp. 341–342, 1956.) It is a new printing thoroughly updated from cover to cover. The "seasonal charts" of the first edition have been extended to include 387 species—all that have been recorded in the state—and thus represent collectively a check-list of Louisiana birds. The nomenclature has been changed to conform to the 1957 edition of "The AOU Check-list." In every respect, "Louisiana Birds" is a most satisfactory regional work, combining precise instruction about birds in general with local birds in particular, while being highly readable, generously and yet pertinently illustrated, and, withal, laudably compact.—Olin Sewall Pettingill, Jr.

A Gathering of Shore Birds. By Henry Marion Hall. Edited and with additions by Roland C. Clement. Illustrated by John Henry Dick. The Devin-Adair Company, New York, 1960: 7⅛ × 10½ in., xii + 242 pp., many bl. and wh. drawings. $10.00.

This book about an attractive group of birds is well organized and pleasing to the eye. Each of the 57 species of North American shorebirds (i.e., the species "known to breed on the North American continent north of the Panama Canal") is treated in a

separate account, headed by a drawing together with common and scientific names of the species concerned, then usually concluded by a statement as to when the species was first described, a list of local names, a digest of field characters, and a description of range. The species accounts (the bulk of the book) are preceded by an introduction to shorebirds in general and followed by condensed listings of shorebirds in other continents, a bibliography, and an index. Jacket, covers, paper, and format are in every respect fine; the pen-and-ink drawings, all by John Henry Dick, are generous in number and beautifully portray not only the vitality and appealing qualities of the bird subjects but also very cleverly allude to special features of their respective environments.

The book, we are told in the introductory matter, "grew out of a series of deft word sketches of shore birds in their haunts" by Dr. Henry Marion Hall, the hunter-turned-conservationist, and some drawings by Mr. Dick. Eventually, in order to "make the book more useful," the publisher enlisted the services of Mr. Roland C. Clement who tried to "bring Dr. Hall's essays up to date in a series of comments on recent changes of status which have occurred, and to interpolate some of the more readable scientific commentaries gleaned from a perusal of an extensive literature. . . ."

The sketches, I find, read nicely and feelingly. As word pictures they can stand on their own and might well have composed a book by themselves. Their weakness in this book is that they are not so much concerned with ornithological facts as they are literary effect, and therefore should not be part of a book that purports to be a work on birds as such.

With these sketches as a basis, Mr. Clement, an erudite ornithologist who writes well himself, has striven mightily to produce a book that will reach and satisfy the widest possible audience. His introduction to shorebirds has the proper tone and substance and thus gets the book off to a good start. The shorter accounts which he has written wholly or in part are praiseworthy. The book's principal shortcomings appear in the longer species accounts—mostly of the well-known and most extensively studied eastern shorebirds—in which Dr. Hall's sketches are allowed to stand as the body of the text without editorial interpolations and corrections. They are inadequate and often erroneous as sources of information and fail to do justice to the abundance of data currently available in various books and journals. Mr. Clement should have edited them much more stringently. Here are a few examples.

The account of the Piping Plover implies that one sex incubates and broods, whereas both sexes do so (see "Notes on the Life History of the Piping Plover" by Wilcox, *Birds of Long Island*, No. 1:1–18, 1939). A recent paper on the same species ("A Twenty Year Banding Study of the Piping Plover" by Wilcox, *Auk*, 76:129–152, 1959) that contained many significant findings is totally ignored. There is no specific information on the breeding habits of the Upland Plover even though there is at least one important study ("The Upland Plover at Faville Grove, Wisconsin" by Buss and Hawkins, *Wilson Bull.*, 51:202–220, 1939) from which appropriate material could have been obtained. The most published-on shorebird in this country, the American Woodcock, is given appalling treatment. Its peculiarly intricate flight song is dismissed in one sentence. The fiction that the parent woodcock carries its young is stated as though it were a proven fact. Neither cited in the text nor listed in the bibliography are the two monographs ("The American Woodcock" by Pettingill, *Mem. Boston Soc. Nat. Hist.*, 9:167–391, 1936; "The Ecology and Management of the American Woodcock" by Mendall and Aldous, Maine Cooperative Wildlife Research Unit, Orono, 1943), or any of the sundry shorter papers on the species, that have been published in recent years. Nowhere in the book is any recognition given to Nethersole-Thompson's "The Greenshank" (Collins, London, 1951) which is undoubt-

edly the most comprehensive work on a shorebird yet published in the English language. A reference to some of its contents in the accounts of the yellowlegs, to which the Greenshank is closely allied, would have greatly enhanced their otherwise superficial coverage.

If one cares to look for minor errors and inconsistencies, he can easily find them. Tattler is commonly misspelled "Tatler," and the following technical names are misspelled or incorrectly written: Phalaropodidae (p. 20), *Jacana spinosa* (p. 24), *Erolia ferruginea* (p. 159), and *Thinocorus orbigyianus* (p. 226). The plural of plover sometimes has an "s" and sometimes not. The quotation from Elliott Coues (p. 175) comes from his "Field Notes on Birds Observed in Dakota and Montana . . . ," published in 1878, not from his "Birds of the Northwest," published in 1874. The bibliography lists only the latter work with the publication date of 1871. The quotation from W. H. Hudson (p. 182) is from "A Hind in Richmond Park" rather than his "Birds of La Plata."

It is a pity that Mr. Clement or another equally competent ornithologist could not have written the entire book, keeping the text readable for popular consumption while at the same time drawing fully from current knowledge and presenting summations of what has been learned about shorebirds. Before the turn of this century Daniel Giraud Elliot, a distinguished ornithologist wrote a popular book called "North American Shore Birds" (Francis P. Harper, 1895). Its information was drawn from the most authoritative sources at that time. Elliott Coues, another distinguished ornithologist who was a contemporary of Elliot's and unrivaled as a severe critic, praised the book at length in a three-page review (*Auk*, 13:64–67, 1896) and wished the book "all the success it so thoroughly well merits." If one is to measure the progress of American ornithology by comparing Elliot's book with "A Gathering of Shore Birds" published over a half century later, he can only conclude that ornithology has been moving at a snail's pace and that somewhere along the way quality of substance has become immaterial.—Olin Sewall Pettingill, Jr.

Atlas of European Birds. By K. H. Voous. Thomas Nelson and Sons, New York, 1960: 10½ × 14 in., 284 pp., 355 photos., 419 maps. $15.00.

This work was originally published as "Atlas Van De Europese Vogels" (Elsevier, Amsterdam, 1960). The present edition is not only translated into English by the author himself, but has profited from the criticisms of and additions to the Dutch edition.

The author states that "The Atlas of European Birds consists of three elements: distribution maps, explanatory text, and illustrative photographs. All are directed to clarifying the extent to which the species here described are maintaining themselves in the world or are extending their ranges." Dr. Voous has treated "species" as a zoogeographical concept. The maps are all the same scale and projection and two sizes are used throughout, considerably easing the production problem. Within these limits the author has succeeded admirably in accomplishing his set task.

The small scale precludes any great accuracy, but even on larger-scale maps it would be impossible to achieve an exactly correct range. Not only do ranges change from year to year, but data are seldom available, either at the right time or, in some areas, with any reliance, and may be lacking entirely in other regions. It seems likely that the final maps for printing were done in an "assembly line" method of inking-in the areas from work sheets—possibly by some technician. Surely Voous knows that the upper Mississippi and Missouri rivers do not flow westward to the Pacific and would have noticed this error had he done the final maps. Very few of the species common to both Europe and America breed in the Mississippi Valley and these species—e.g., the Little Tern (*Sterna albifrons*), map 199, p. 152—are properly plotted. The ranges stand very close checking

indeed and show that the author did not rely on one general work or description, but must have consulted a large body of recent literature.

Any range maps are extremely vulnerable targets; within his stated aims Dr. Voous has left little at which to shoot. Additions of winter ranges and migration routes would have made the book much more valuable. This is probably asking for more of a very good thing, as winter and migration ranges are much more fluid and more difficult to map—impossible to map to everyone's satisfaction. Disjunct breeding ranges—e.g., the Whimbrel (*Numenius phaeopus*), map 150, and the Marsh Sandpiper (*Tringa stagnatilis*), map 158—may be the result of migration patterns or winter distribution as well as of glaciation patterns as proposed in the text.

There is an inconsistency in the application of the red overlay on the maps; on some maps, Black Sea is covered with the red and on other maps the Sea is left clear. During the press run, perhaps, red spots were added at places where Dr. Voous had no intention of their appearing. In the three copies available to me, such spots were present at least as follows: maps 18, in Brazil; 50, south of Newfoundland; 67, in southern Sweden; 81, in western Africa; 104, in eastern Siberia; 153, in Mongolia; 167, blotch south of the Commander Islands; 173, spot in Southwest Africa, and another south of the Canary Islands; 193, spot on Cape Blanco in Spanish Sahara; 202, one southeast of Ascension Island; 264, one in South Africa; and 389, probably the spot in central Russia.

There are 419 species mapped; these include 189 species which are listed in the 5th edition of the "Check-list of North American Birds." The common names used are those of the British Check-list. The scientific names generally follow European concepts where there is less tendency to use small or monotypic genera. The following is a list of species-groups and pairs considered one species by Voous and of particular interest to North Americans:

Species name used in Atlas	Considered conspecific
Sula [= *Morus*] *bassana*	*M. capensis, M. serrator*
Anas platyrhynchos	*A. diazi, A. fulvigula, A. oustaleti*
Anas crecca	*A. carolinensis*
Anas acuta	*A. eatoni*
Cygnus columbianus	*C. bewickii*
Buteo buteo	*B. jamaicensis*
Elanus caeruleus	*E. leucurus*
Haematopus ostralegus	*H. palliatus*
Tringa [= *Actitis*] *hypoleucos*	*A. macularia*
Himantopus himantopus	*H. mexicanus*
Stercorarius [= *Catharacta*] *skua*	*C. antarctica*
Glaucidium passerinum	*G. gnoma*
Sitta canadensis	*S. whiteheadi, S. kruperi, S. yunnanensis, S. villosa*
Regulus ignicapillus	*R. satrapa*
Lanius excubitor	*L. ludovicianus*
Carduelis [= *Acanthis*] *flammea*	*A. hornemanni*

All of these are according to Voous' expressed zoogeographical concept of species. The relationships are discussed in the text, as are other close relatives and "replacement species." The maps should not be used without reference to the text in which he dis-

cusses (sometimes much too briefly) the migration and winter ranges as well as faunal type, habitat, food, and nesting.

Zoogeographical regions used are combinations of those proposed by Sclater and Wallace; climatic zones are based on the scheme presented by the Finnish meteorologist, J. M. Angervo, after Koppen. These are presented on maps in the introductory section plus a world map of January and July isotherms and often referred to in the text. The faunal types used are briefly defined in the same section.

The photographs add much to the attractiveness of the book. The author says "Where possible, they show each species in its characteristic haunts. . . . It has proved impossible to obtain a photograph of every European breeding bird. . . . For some species, the only photographs available do not show the bird in its habitat; nevertheless, these have been included since they mainly show rarely photographed species." Ninety-three species are not pictured at all—an amazing number in this day when the camera reigns supreme. Since so many species have not been photographed in suitable habitat, or at all, the inclusion of several general photographs of the more limited faunal types such as "Chinese–Manchurian" or "Sarmatic," if available, would have been helpful.

The book has remarkably few typographical errors. "Savanna" is apparently spelled throughout minus one "n." The maps of species breeding in North America are questionable generally only in more minute detail. Map 184, p. 147, of the Common Gull (*Larus canus*) indicates that the species breeds in all of Yukon Territory and into northwestern MacKenzie; this apparently was mapped from the word description in the 5th edition of the "Checklist of North American Birds," whereas the bird evidently breeds only in southern Yukon and possibly does not *now* breed in northwestern MacKenzie.

Dr. Voous will evidently be grateful for any additions and corrections which might be made. This edition incorporated changes on 138 maps from information received after publication of the Dutch edition. The work is a must for those interested in zoogeography, ecology, or taxonomy, and will make a handsome addition to the library of anyone interested in birds.—E. M. Reilly, Jr.

The Parasitic Weaverbirds. By Herbert Friedmann. Smithsonian Institution, United States National Museum Bulletin No. 223, 1960: 196 pp., 16 pls. (4 col.). $1.00.

This is Herbert Friedmann's fourth monograph on parasitic breeding habits of birds. His well-known earlier books dealt with three other families that contain parasitic species: the cuckoo, honeyguide, and blackbird families.

The present volume is divided into two main sections. The first discusses the phylogenetic and ethological background for brood parasitism, the antiquity of the habit, and the presumed adaptive value for parasitism of "the remarkable similarities in the color of eggs, in the pattern of nestling mouth markings, and in the nestling plumage of viduines and of their usual foster nest mates." Dr. Friedmann notes that "these similarities are more probably due to community of descent rather than to any convergence developed after the advent of brood parasitism." He also observes that "the parasitic weavers possess no known special structures, habits, or functional gradients that give them particular advantages over their nest mates, but this condition does not mean that they are not adequately equipped for competing with them on equal terms."

The second, and larger, section of the book deals with individual species of parasitic weaverbirds under such headings as "Distribution," "Breeding Season," "Songs and Calls," "Courtship," "Territorial Behavior," "Mating," "Eggs and Egg Laying," "Hosts," "Young out of the Nest," "Food and Feeding Habits," and "Plumages and Molts."

Monographs such as the present volume are invaluable because they summarize available information and point up the vast amount of work still needed on brood parasitism. Not until 1907 was it discovered that parasitism occurs among the weaverbirds. "Of not one of these species is our present knowledge more than partial; of some it is still extremely fragmentary." The author hopes that publication of "The Parasitic Weaverbirds" will "stimulate observers to supply further data and at the same time expedite their work by directing them to the gaps" that he has not been able to close either by his own field work or from the literature, but ornithologists are fortunate, as well, in having Dr. Friedmann's carefully considered conclusions on the broad aspects of brood parasitism among the weaverbirds.—ANDREW J. BERGER.

XII INTERNATIONAL ORNITHOLOGICAL CONGRESS, HELSINKI 5.-12. VI. 1958. PROCEEDINGS. Edited by G. Bergman, K. O. Donner, and L. von Haartman. 1960. Vol. 1, pp. 1–436; vol. 2, pp. 437–822, paper bound. (Can be ordered from Zoological Institute, University of Helsinki, Finland.)

These volumes include the Presidential Address of J. Berlioz, the Report of the General Secretary of the Congress, L. von Haartman, the Report of the Standing Committee on Ornithological Nomenclature by F. Salomonsen, and 97 papers (51 in English, 11 in French, and 35 in German). Papers vary from two to 32 pages and provide an international coverage of a multiplicity of ornithological topics. An index of species and genera is provided.

Without attempting to indicate the full spread of subjects included, several papers may be mentioned to show the significant nature of the contributions. On the theme of adaptations, R. W. Storer writes an informative account of the evolution of diving and swimming in different groups of aquatic birds, and G. Kramer, through a study of flight in gulls, develops the thesis that allometric growth is fundamentally adaptive. In the areas of distribution and ecology, H. Johansen presents in succinct form a concept of the nature and origins of the arctic avifauna, S. D. Ripley reports on four species of megapodes inhabiting together the small island of Misool, and A. N. Formozov describes a 10-year study showing close correlations of population size in crossbills and woodpeckers with fluctuating seed production of coniferous trees in Russia and Siberia.

Physiological investigations are reported by A. Wolfson in a discussion of extensive experiments aimed at the elucidation of the role of light and darkness in the regulation of the annual stimulus for spring migration and reproductive cycles, while K. O. Donner writes on the effect of colored oil droplets on the spectral sensitivity of the avian retina. Topics on behavior are of world-wide scope. H. Sick compares courtship in ten species of manakins (Pipridae). R. Drost discusses nocturnal migration over Helgoland as affected by factors such as moonlight, fog, temperature, and wind. F. and F. Hamerstrom contrast the social displays of Black Grouse and Greater Prairie Chickens. Among the papers on paleontology and phylogeny, that of U. Glutz von Blotzheim supports the theory that ratites were derived from an ancestral pro-avian stem prior to its acquisition of flight.

The papers are arranged alphabetically according to author. This is convenient, but threads of continuity achieved in the Congress through grouping of papers into topical sessions are snapped. Had a subject organization been retained, the results would be of easier access to the reader wishing to scan the volumes for advances in particular fields. In all, these two volumes ably carry on the excellent tradition established by the previously published proceedings of the International Ornithological Congresses.—PAUL H. BALDWIN.

SONGS OF FRINGILLIDAE OF EASTERN AND CENTRAL NORTH AMERICA. Volume VI of the "Sounds of Nature" Series. Recorded by Donald J. Borror and William W. H. Gunn; narration by Thom Benson. Federation of Ontario Naturalists, 187 Highbourne Road, Toronto. $5.95.

On this record are about 400 songs of 226 individuals representing 43 species of fringillids in eastern and central North America. Probably no other bird-song record has been so effectively devised to satisfy the interests of both the beginning and advanced bird watcher, the critical recording technician, the research ornithologist, and the teacher of ornithology.

Of very special value is the inclusion of more song variations per species than is usual in such records. The average is about nine variations to a species, the maximum being 20 in the case of the Cardinal. Usually the songs have been recorded in different parts of a species' range, thereby demonstrating geographic as well as individual differences. At the same time, most of the recordings give a good concept of "typical" song patterns.

The sequence of species is arranged according to similarities of songs, which have been classified in nine groups. This enables the listener to compare more directly the songs of species with similar melody patterns and other resemblances.

The mechanics of recording have been handled expertly. Tone quality is excellent. Background noises are kept down. For the most part, unusually good judgment has been applied to details of organization, such as the spacing of songs and the length of announcements.

On the jacket is an alphabetical index to species that facilitates finding their songs on the disc by band numbers. There is also a list of species in the order of singing that gives the band numbers, the number of individuals singing, and the number of songs.

Accompanying the record is a three-page mimeographed insert that includes information as to the state or province and the month in which each song was recorded. In some cases a key number provides even more exact locality data. Under "Miscellaneous Notes" a few helpful comments and analytic remarks are supplied. A note at the end states that "a detailed analysis and description of these songs, illustrated by spectrographs, is in preparation." Reprints will be available through the Federation of Ontario Naturalists.

It is hard to find fault with this record. The announcer's three-syllabled pronunciation of "McCown's" will be jarring to some people. Nowhere is there any statement or other satisfactory indication as to exactly what it is that the announcer is enumerating every time he gives a number. Only after much listening and reading can one ultimately figure out just what is being enumerated.

Most of my adverse criticisms are related to the classification of songs. For example, it is not readily apparent why the songs of Blue Grosbeak, Indigo Bunting, and Dickcissel should be described as "a series of loud, unwavering phrases, successive phrases often similar," without requiring excessive elasticity in the concepts "unwavering," "phrase," and "similar." The classification of Baird's Sparrow among the "buzzy songs" leads me to inquire whether musical terminology is really so ambiguous that what is commonly recognized as the musical, tinkling trill of the Baird's Sparrow should also be called "buzzy." Followers of the Aretas Saunders school of thought will not agree that each separate group of notes rendered by a Bachman's Sparrow should be considered an individual "song"; they would call it one "phrase" in a "long-continued song." To me the latter seems the more fitting categorization. The classification assigned to a few other species may be debated, but on the whole the grouping of the songs seems logical.

This record is a long step forward in the production of pleasing and useful recordings of bird sounds. In my opinion, it is superior even to the excellent record of warbler songs by the same authors.—HAROLD H. AXTELL.

THE BIRDS OF FINCA "LA SELVA," COSTA RICA: A TROPICAL WET FOREST LOCALITY. By Paul Slud. Bulletin of the American Museum of Natural History, Vol. 121, Art. 2, 1960: pp. 49–148, 5 text figs., 19 pls., 1 table. $2.75.

From the title, one might assume this to be the usual annotated list type of paper based on a series of collected specimens and short-term observations. It is, however, an important attempt at an "ecological classification" of 331 species of birds observed during a year spent on a 1,500-acre plot of tropical forest, in the northeastern Caribbean lowlands of Costa Rica.

According to Slud (p. 77), "The way to classify birds ecologically . . . is to place them in their habitat and describe what they do, so that habitat plus behavior add up to niche. . . ." To do this he first analyzes the habitat requirements and the general behavior of all 331 species, comparing and contrasting the species within each family with one another. Then, within a framework of five major habitats (viz., Forest, Second Growth, Tree Plantations, Watercourses, and Aerial) and a varying number of subdivisions of each habitat (e.g., Forest Floor, Understory, Middle Forest, Canopy, and Above the Forest), and at times smaller subdivisions (Terrestrial Species and Semi-terrestrial Species), the 331 species are arranged, giving an "ecological classification." Under each ecological grouping there is a rather comprehensive account of how the various species interact and utilize the habitat.

The paper concludes with a detailed, and convincing, argument for considering the suboscines to be a successful group which thrives in the neotropics, rather than as a group taking refuge there while gradually being replaced by the oscines.—RAYMOND A. PAYNTER, JR.

BIRDS OF THE WEST INDIES. By James Bond. Color illustrations by Don R. Eckelberry; line drawings by Earl L. Poole. Houghton Mifflin Company, Boston, 1961: 5¼ × 7¾ in., 256 pp., 8 col. pls., 186 line drawings, 2 end-paper maps. $6.00. (British edition published by Collins, London, 1960; price 35s.)

Although not specifically stated, "Birds of the West Indies" is a revision of Bond's "Field Guide to Birds of the West Indies" (1947), which in turn was a revision of his earlier "Birds of the West Indies" (1936). The first book was good, the second better, and the latest excellent. Except for the addition of more colored plates, and the elimination of the dark and fuzzy line-cuts, it is difficult to envision how this evolutionary process can continue.

The most notable change over the 1947 book is the inclusion of eight colored plates illustrating 66 endemic, or the more exotic, West Indian species or subspecies. The depiction of all the West Indian parrots, except for the introduced Guiana Parrotlet (*Forpus passerinus*), is particularly welcome. The portraits are accurate and lively; Eckleberry seems to be the only contemporary artist who can successfully combine these two qualities in field guide illustrations.

Other changes are more subtle but add considerably to the clarity of the book. A brief characterization now precedes each family and the species accounts are more clearly divided into topics (i.e., local names, description, voice, habitat, nidification, and range). The list of birds covered in detail has been reduced by the relegation of the vagrant species to a list at the end of the text. The typography is vastly improved. These changes have resulted in a book which is now attractive, as well as eminently useful.—RAYMOND A. PAYNTER, JR.

BLIND JACK. By Stephanie Ryder. Houghton Mifflin Company, Boston, and The Riverside Press, Cambridge, 1961: 5½ × 8½ in., xiv + 145 pp., 9 photos. $3.25.

"Blind Jack" is not only an unusually appealing story but is also a worth-while account of the behavior of one of the more "social" birds (a Jackdaw) that is forced, by blindness, to develop and accept dependence upon a human being. "Jack," it seems, could not have fallen into better hands. Mrs. Ryder displayed an absolutely amazing ability to anticipate and meet the needs of a bird which had been deprived of its most essential sense—sight. For how can a sightless bird find its food and water? Fly without bumping into things? Seek shelter? Jack's owner sensed and met these problems with solutions which resulted in a quite satisfactory adjustment on the part of her patient.

Because of the bird's blindness, the author was able to examine him from a distance of a few inches, thus gaining an unparalleled view of many of his activities, such as the way he preened, or used his tongue in eating. Clearly and carefully she described, in simple terms, such activities as preening, bathing, anting, and the behavior associated with apparent fright, uncertainty, relief, loneliness, and other sensations. Behavior patterns were noted and described, but conclusions were drawn with extreme caution. When more than one interpretation was possible, the author has given it. If there was a possibility of doubt, she says, "At least this was my impression."

Extremely interesting is the account of the ways in which the Jackdaw learned to use his feet to compensate in some way for his visual loss. He made exploratory, reaching motions with them. He grasped his food with them, once he found it. He flew with his feet extended in front of him, tail pointing down, once he had "learned" that this would save him from serious bumps into objects. He used them to climb curtains to a safe and familiar perch on a valance.

Mrs. Ryder truly put herself in Jack's place, time and again, in helping him to overcome difficulties, and in all ways she respected his dignity, and took care to help him to maintain his poise.

I found her style of writing slightly awkward at times, but this is a very minor criticism of a book which will be enjoyed by all students of bird behavior, amateur or professional.—SALLY F. HOYT.

PIRATES AND PREDATORS: THE PIRATICAL AND PREDATORY HABITS OF BIRDS. By R. Meinertzhagen. Oliver and Boyd, Edinburgh, 1959: 7½ × 10⅞ in., x + 230 pp., 44 pls. (18 col.). 70s (about $9.80).

This, Colonel Meinertzhagen's latest book, is a vast collection of observations on "the manner of hunting" by birds. Although many observations have been drawn from the literature, the majority are the author's, obtained over a period of seventy years in many parts of Europe, Africa, and Asia.

The subject matter is organized in four parts under four main headings. Part 1, "Man, Predators, and Vermin," deals with some of the general aspects and methods of predation. Part 2, "Predators—Amateur," concerns a wide variety of birds not strictly predatory. Part 3, "Predators—Professional," has to do with the falconiform and strigiform birds. Part 4, "Autolycism" (the habit of one organism "making use of" another), presents many notes on birds making use of other birds, man and other mammals, and reptiles and fish.

Writing with terseness and objectivity, Colonel Meinertzhagen minces no words in stating an idea or opinion, however colorful. While his style has commendable virtue,

permitting him to reach points quickly, it is apt to leave the reader (my case anyway) yearning for more details. This is especially true in those passages about unusual actions which he has been fortunate to witness. Many times I wanted to know the circumstances and just how the predators and/or prey behaved.

On the whole, the book is a strong defense of predation and a clear exponent of its biological implications. There is no injection of sentimentality, no playing down the high drama and goriness of predatory assaults. Keen admiration is actually demonstrated for most predators, avian or otherwise. One notable exception is man ("the vilest vermin... both vermin and weed—not a nice thought; but then man is not nice").

It is regrettable that a book so replete with noteworthy accounts of predator–prey relationships should be so poorly indexed. Its two concluding pages, titled "Index," give simply an alphabetical listing of the book's subtitles and their page numbers. To determine what the author has written about a particular species, one must go through the book page by page.

"Pirates and Predators" is elegant in both manufacture and format and a great credit to its Scottish publishers, Oliver and Boyd, who have already brought out several fine books on birds. The color plates are excellent reproductions of dynamic paintings by such talented wildlife artists as G. E. Lodge, D. Millais, and C. F. Tunnicliffe. The black and white plates are mostly from striking photographs by R. Austing, Eric Hosking, and other cameramen. All the illustrations are appropriate to the text. No doubt many of the paintings were especially commissioned by the author. For a book embodying so many superior qualities, its price is remarkably modest.—Olin Sewall Pettingill, Jr.

Proceedings of the First Pan-African Ornithological Congress. Supplement No. 3 to *The Ostrich*. South African Ornithological Society, 1959: $7\frac{1}{2} \times 9\frac{3}{4}$ in., ix + 445 pp., illus. 26*s* (about $3.65). (Obtainable from S.A.O.S. through Dr. G. J. Broekhuysen, Department of Zoology, University of Cape Town, Rondebosch, C. P., South Africa.)

The First Pan-African Ornithological Congress was conceived after an invitation to the International Ornithological Congress in Basel in 1954 failed to lure that august body to hold its twelfth convention in South Africa. Undaunted by this rebuff, the South African Ornithological Society, with the help of several sister organizations, organized and conducted a highly successful congress in Livingstone, Northern Rhodesia, in July of 1957. About 200 ornithologists from 19 countries attended the sessions including 28 from the United States and three from Canada.

The published proceedings of this congress comprises a substantial volume printed on gloss paper and bound in a heavy textured paper. Line drawings and half-tones are of mediocre quality. Following a few brief introductory chapters, the 55 papers presented at the session are published in their entirety, many of them followed by concise summaries of the discussions they raised. A few of the papers, extending up to 42 pages, were presumably amplified or supplemented for publication. Papers were arranged by subject matter into nine sections: conservation (7), distribution (11), ecology (4), general biology (11), history (2), migration (6), parasitology (2), song (4), and systematics (8).

The series of reports on bird conservation in the various countries and provinces of southern Africa reveals to the American reader a rather unfamiliar picture of protection efforts in a land where hunting for sport is rare, where marketing of game has never been highly organized as it was in early America, and where birds of all sorts are sur-

reptitiously snared for family consumption according to their accessibility and ease of capture. Most of the countries now give blanket protection to all but a rather small list of species which are classified as destructive or which in their continuing abundance have demonstrated a satisfactory resistance to prevailing pressures.

Among the many worthy contributions are: a summary and analysis of the peculiar discontinuous ranges of montane forest birds of southern Africa, by Richard Liversidge; a demonstration of how accumulated deposits of owl pellets have provided data on the faunal composition, population dynamics, and historical changes of small mammals populations, by D. H. S. Davis; discussions of the incidence and significance of color dimorphism in egrets, by P. Milon and J. Berlioz; a consideration of the reproductive cycle of sunbirds near the equator, by J. Chapin; an account of government efforts to control the "swarms" of destructive Quelea finches in South Africa, by T. J. Naude; and a discussion of the effects of day-length changes in the southern hemisphere on transequatorial migrants, by G. J. Van Oordt.

Important papers on life history are presented by G. J. Broekhuysen for the Sugar Bird (*Promerops cafer*), by T. Oatley for several robins of the genus *Cossypha*, and by C. J. Skead for the Penduline Tit (*Anthoscopus minutus*). In this latter species, whole families of up to 18 birds crowd together each night to sleep in remarkable felted nests of spider silk and wool.

Outstanding as a challenge for further field research is an 18-page paper on some aspects of speciation in the birds of Rhodesia and Nyasaland by C. W. Benson, M. P. Stuart Irwin, and C. M. N. White. Over 50 fascinating examples of what are thought to be sibling species, species pairs, geographically separated species pairs, and ecological races are listed and briefly described. This is followed by brief but thought-provoking speculations on speciation factors, isolation factors, and the recent history of the central African avifauna.

This volume constitutes a milestone of progress in the advancement of African ornithology and contains much of interest to ornithologists everywhere.—JOHN T. EMLEN, JR.

PENGUIN SUMMER: AN ADVENTURE WITH THE BIRDS OF THE FALKLAND ISLANDS. By Eleanor Rice Pettingill. Clarkson N. Potter, Inc., New York, 1960: 6 × 9 in., 197 pp., 68 photos, end-paper maps. $5.00.

When I heard the Pettingills were going to the Falkland Islands, three hundred miles off the tip of South America, to take photographs of penguins for Walt Disney, I thought, "To see penguins! That's one trip I'd like to know *all* about—every detail!"

Now Eleanor Pettingill has written the story in "Penguin Summer" and I am utterly satisfied. Her account of their adventures is so vivid and intimate that as I finish the book I feel I have been taking the trip with them, and I can hardly wait to make it again by re-reading.

Though "Penguin Summer" is filled with information, precise and authentic, on the birds of the Falklands (penguins, of course, but many others too), on the vegetation, the physical aspects of the islands, the social customs and ways of livelihood there, it is never pedantic. It is a delightful, spontaneous story of their project, day by day, from the first vague idea of photographing penguin colonies, to the visit's end.

Every phase of the trip is handled with vivacity and humor, whether Eleanor tells of a formal dinner with the Governor or a rough camping experience where the weather

discomforts are almost too actual. The very fact that Sewall Pettingill's accident is not over-emphasized makes it the more harrowing for the sympathetic reader. While both people and birds in the book become real friends, of course the penguins are the heroes of the story, and the descriptions of them are captivating. For instance:

"The penguins were having a party. The birds in the small groups were clicking bills, the way puffins do in the Northern Hemisphere. Two birds would walk up to each other, put their heads together as if exchanging secrets, then click their bills together faster and faster. They were joined by others till there were six or eight in a circle, all leaning toward the center, clicking bills madly. Then suddenly they all raised their heads and walked away."

And— "We watched the penguins going to sea. Although they landed on only one rock, they left from several places. Some walked cautiously down a smooth ledge and waited for the waves to sweep them seaward; most of them, however, climbed in groups up a broken ledge . . . , peeked over, backed up, went forward again, and finally jumped in feet first. . . . If they could have held their beaks with their flippers they would have looked just like the kids in the old swimming hole. But there were some that walked to the edge, took one look, turned around, hopped back to the slanting ledge, and waded in."

If you want to learn of the life cycle of the penguins, or find accurate scientific information about the Falklands; if you'd like to know what diddle-dee and mollymawks and clapmatches are; or if you simply want to go on a fascinating expedition, by all means read "Penguin Summer."—Florence Page Jaques.

PUBLICATION NOTES AND NOTICES

The Caribbean Journal of Science (Vol. 1, No. 1, February 1961) is a new mimeographed publication to be issued quarterly by the Institute of Caribbean Studies. It will report primarily on local and regional studies in botany, zoology, and other sciences in the Caribbean area. Subscriptions ($2.00 in the United States) are payable by check to "University Bookstore, Mayagüez" and should be sent to Dr. W. A. Gordon, Institute of Caribbean Studies, University of Puerto Rico, Mayagüez, P.R.

The Alaska Conservation Society News Bulletin, a mimeographed quarterly now in its second year, should be read by everyone concerned about the state's enormous wildlife problems. Associate Membership ($2.00) is open to non-residents of Alaska and includes a subscription to the *Bulletin*. Checks are payable to the Alaska Conservation Society and should be directed to Box 512, College, Alaska.

Binoculars & Scopes: How to Choose, Use & Photograph Through Them. By Robert J. & Elsa Reichert. Chilton Company, Philadelphia, 1961: 4⅞ × 7¾ in., 128 pp., 55 text figs. $1.95 (paper); $2.95 (cloth).

A carefully detailed, profusely illustrated manual, with a wealth of optical data and helpful suggestions.

Dusky and Swallow-tailed Gulls of the Galapagos Islands. By Alfred M. Bailey. Denver Museum of Natural History, Museum Pictorial No. 15, 1961: 32 pp., 19 photos., 1 map. Paper covered. $1.00.

Another in the Denver Museum's series of handsomely illustrated booklets. Worthwhile information is given on both *Larus fuliginosus* and *Creagrus furcatus*.

A Study of Certain Plant and Animal Interrelations on a Native Prairie in Northwestern Minnesota. By John R. Tester and William H. Marshall. Minnesota Museum of Natural History, Occasional Papers No. 8, 1961: viii + 51 pp., 1 photo., 17 text figs., 14 tables. Available upon request to Minnesota Museum of Natural History, University of Minnesota, Minneapolis 14.

This is based on a field study at the Waubun Prairie Research Area in northwestern Minnesota "to determine the nature of the relations between specific vegetational characteristics of the dominant grasses and litter found on a native prairie and changes in distribution and abundance of certain birds, mammals, and insects . . . during the growing seasons of 1957, 1958, and 1959." The three bird species given special attention are the Bobolink, Savannah Sparrow, and Le Conte's Sparrow.

Bird Mortality in the Dutch Elm Disease Program in Michigan. By George J. Wallace, Walter P. Nickell, and Richard F. Bernard. Cranbrook Institute of Science [Bloomfield Hills, Michigan] Bulletin 41, 1961: 44 pp., 4 tables. $1.00.

The authors "are inclined to question the whole program, as currently conducted, on ecological grounds. Any program which destroys 80 or more species of birds and unknown numbers of beneficial predatory and parasitic insects needs further study."

The Mallard. By John Madson. Conservation Department, Olin Mathieson Chemical Corporation [East Alton, Illinois], 1960: 90 pp., 18 photos. Available upon request.

The contents of this attractive booklet are grouped under five headings: "Life History," "Parasites and Diseases," "Management," "Hunting," and "Man and the Mallard."

ANNUAL REPORT OF THE CONSERVATION COMMITTEE

Rapid expansion of the human population and increasing emphasis on economic growth make it essential that bird conservation problems be kept under constant surveillance and anticipated in advance where possible. Expansion of urban areas, highway construction, and intensive agricultural, industrial, and recreational development are bringing about a modification of the habitat of birds. A sustained effort to appraise the effect of this "new frontier" on bird life and to temper undesirable changes whenever feasible is highly desirable. The ornithologist must show increased aggressiveness if bird conservation is to have meaning in the future. He must assign more research effort to the objective of obtaining increased knowledge of, and solutions to, bird conservation problems, and he must take a greater part in insuring education of the general public and in securing needed legislation.

Using an earlier committee report (Scott, 1958) as a guide, we might examine the bird-conservation problem from a "what to do about it" point of view. The major points of concern separate into the following categories: (1) conservation education, (2) land-use problems, (3) habitat pollution (pesticides, oil, etc.), and (4) control of bird populations. More often than not, the names of birds are added to lists of endangered species and subspecies as a consequence of limitations which may be classified in one or more of the above categories. Vanishing species and subspecies, however, will be discussed in a separate section of this report.

One objective of the conservation committee is to explore and report upon special problems. Two of these reports, one in the area of a land-use problem (Jahn, 1961) and the other on the status of grouse populations (Hamerstrom, 1961), have been presented. We are anticipating additional reports from Charles H. Callison (conservation education), Joseph J. Hickey (pesticides), and Harold Mayfield (Kirtland's Warbler refuge).

The status of research dealing with problems of bird conservation is a cause of concern to the committee. Evidence indicates that there is some apathy among scientists about devoting research time to the solution of problems relating to bird conservation. Additional stimulus may be needed. Although funds for research are available from many sources, funds for use in attacking problems in bird conservation are frequently inadequate. This is a matter which requires thorough appraisal. Perhaps the committee can arrange for an enlightening review.

CONSERVATION EDUCATION

Man tends to be apathetic toward conservation of the apparently unessential natural elements of his environment. Perhaps this is eternally true, and perhaps it is partly a reflection of adaptation to his changing universe. Over the past 200 years the average man in this country has been losing contact with his natural world. It is conceivable that this change from virtual dependence on the wild elements of his environment to an environment of concrete, stainless steel, and supermarkets has had a profound effect on human appreciation of nature. Reduced contact with nature surely lessens appreciation for it and increases apathy which, in turn, keeps even those who are potentially conservation minded from acting, until, in some instances, there is nothing left to appreciate.

The common denominator in all conservation problems is conservation education. The warm feeling which most Americans have for birds must be encouraged; it seems apparent that this can be done most effectively through organized programs of conservation education. In this way intelligent support for bird conservation can be insured.

Many of the notable advances in the conservation of natural resources probably had their initial origin in the classroom. Our grade schools and high schools have made a contri-

bution to the enjoyment and understanding of natural history by the American public, but it is unfortunate that most such training is given indoors. Acquisition of small natural areas to be used as outdoor laboratories by secondary schools has been recommended by some educators as an aid in developing nature appreciation.

A number of organizations not directly connected with public school systems have contributed much to outdoor education. As one example, the Forest Preserve District of Cook County, Illinois, for many years has conducted a program aimed at teaching sound attitudes toward the out-of-doors to children and adults of the Chicago metropolitan region (McCabe, 1952). The more than 45,000 acres of the Forest Preserve are within easy reach of the people of that region. More than 80 per cent of the area can be called "wild" land in that it is kept as nearly as possible as natural woodland and is accessible only by foot trails or bridle paths. Competent naturalists conduct classes from the public schools, or from the Forest Preserve's day-camps in summer, on field trips to woodlands, marshes, or lagoons, where the fundamentals of botany, forestry, and aquatic and terrestrial zoology are explained in understandable terms. Naturalists also give talks in school classrooms on natural history and conservation, and co-operate with teachers colleges in giving instruction to teacher candidates in outdoor education. Both adults and children are reached through radio programs and by weekly nature bulletins sent to 135 newspapers, including the city dailies and about 50 foreign language newspapers, in the Chicago area. This program has been successful beyond expectation in improving outdoor manners and in arousing interest in natural history.

The recent establishment of the Natural Science for Youth Foundation, whose purpose is to stimulate, guide, and assist local communities in the development of natural science centers for children and youth, and also the recent merger of Nature Centers for Young America, Inc., with the National Audubon Society appear to be important steps forward in the field of conservation education. According to Carl W. Buchheister (*Aud. Leader's Cons. Guide*, 2(5), 1 March 1961), President of the National Audubon Society: ". . . it is our purpose to operate the Nature Centers program as one of the major educational extension arms of the Society. It will be coordinated closely with the Society's other educational activities. The staff of NCYA is made up of able, dedicated people.

"With the stimulus and the support that can be given the program by NAS branches and affiliates throughout the nation, we shall look forward to a steady growth in the Nature Center movement. No other device or program appears to hold so much promise of giving millions of urban children an understanding of their affinity with nature, and of their dependence upon the natural resources of America."

The Nature Conservancy plans to embark soon on a "Natural Areas for Schools" program. A preliminary exchange of information between the Audubon Society and the Nature Conservancy indicates that the programs of these two agencies need not compete or overlap. The two organizations will work together to assure coordination. The Nature Conservancy's efforts will be directed toward the acquisition or dedication of areas of land that can be used by schools as outdoor laboratories for natural science classes. The nature centers promoted by the National Audubon Society or by the Natural Science for Youth Foundation will in most instances be larger, with a staff and associated nature museum facilities, and they are intended to serve all the schools and youth groups in an urban community, and, to the degree that they can be accommodated, adult groups as well.

LAND-USE PROBLEMS

The increasing demand for space in which to live and work and the growing demand for the things which can be produced on the land are affecting the bird fauna through

altered habitat. Some avian populations may have been favored, and some, such as the prairie chicken in Illinois and Wisconsin, are in danger of regional extirpation. Refuges or modification in land-use practices may be required in specific instances to protect birds. Ornithologists should make every effort to keep informed on species endangered by habitat alteration and to encourage corrective action wherever needed.

Ornithologists and sportsmen have been slow to realize that often they can work effectively together toward important conservation goals, especially where the problem is related to land use. Of the two groups, perhaps the bird people have been the less willing to look for a common ground of interest. The National Audubon Society, however, seems to be taking the initiative in promoting cooperation among different groups of outdoorsmen. Recently, the president of the National Audubon Society took to task both the duck hunters and bird watchers for not protesting vigorously the threatened drainage of Tule Lake National Wildlife Refuge (Buchheister, 1960).

It was encouraging to learn that a memorandum pledging support of conservation programs on military installations was approved during the past year in the Defense and Interior Departments. According to a report by Poole (1960:2), the "agreement stipulates that 'All military installations or facilities which contain suitable land and water areas as determined after consultation with autherized federal or State conservation authorities, shall have an active, progressive program for the management and conservation of fish and wildlife resources consistent with the missions of the installations.'" It is highly probable that this program will be oriented around game animals. It would seem desirable that ornithologists near military reservations make an effort to obtain recognition of nongame bird needs.

In the majority of states in the north-central region, it seems possible to preserve for the future some of the remnant colonies of Greater Prairie Chickens only by establishing a checkerboard pattern of 20-acre or 40-acre refuges in agricultural lands. Such refuges must be kept permanently in grass for nesting cover. This is a major undertaking requiring acquisition and management of considerable acreages of land. In states where the prairie chicken is no longer classed as a game bird, conservation departments have been reluctant to purchase land for refuges except where game species still subject to hunting will also benefit. In Illinois, as in Wisconsin, several conservation agencies are co-operating in attempts to raise funds for a system of prairie chicken refuges in upland farming areas. The Illinois Prairie Chicken Foundation (parent organizations: Illinois Federation of Sportsmen's Clubs, Illinois branches of the National Audubon Society, Izaak Walton League, and Nature Conservancy) has undertaken the task of raising funds by private subscription to purchase refuge land that costs up to $200 an acre, and is exploring other sources of possible financial assistance.

In Wisconsin, where a similar program was initiated in 1954 by the Wisconsin Conservation League and the Wisconsin Society for Ornithology, land acquisition is now proceeding at a steady pace under the auspices of the Prairie Chicken Foundation. These organizations, as well as three private citizens, have now acquired over 1,800 acres at a cost in excess of $40,000; and the scattered blocks of land are leased to the Wisconsin Conservation Department which is managing them intensively.

The Lesser Sandhill Crane has thrived and perhaps increased in numbers during the past decade on relatively undisturbed breeding grounds in Alaska and northern Canada. However, agricultural encroachments upon feeding and concentration areas in Saskatchewan, the Dakotas, and Nebraska, and upon wintering areas in Texas and New Mexico, spell trouble for the species. Pressure for hunting as a means of relieving depredations resulted last year in an "experimental open season" declared by the Secretary

of the Interior for certain areas in Texas and New Mexico, a season that Texas couldn't take advantage of because of a state law against crane hunting. In several respects the "experimental season" was unsatisfactory; there was little hunting pressure and the number of birds taken was probably too small a sample to reveal anything definitive about age composition. The experience did reveal a number of questions that need to be answered through research before a management program can be devised for the species. We need to know, for example, the extent to which the birds winter in Mexico, or move into and out of Mexico during the wintering season, and the amount of hunting pressure, if any, sustained in Mexico.

A field investigation in 1960 by the National Audubon Society and the Audubon Society of Canada of the crop-depredations problem in Canada, the Dakotas, and the Southwest, plus observations of the experimental hunting season, has led the two societies to conclude, quite aside from the question of hunting, that the only certain answer to the depredations problem, and a step essential to the future protection of the species, is the acquisition of additional refuge lands for the Sandhill Crane in Saskatchewan, along the flyway, and in the Southwest. Otherwise, the progressive encroachment of farming with attendant demands for "control" will certainly endanger the species.

It seems obvious that cranes, with their low rate of reproduction and restricted habitat, can never sustain more than a small hunting harvest at best. Further, it would seem unwise to permit hunting in areas where the range of the Lesser Sandhill Crane overlaps that of the Greater Sandhill Crane, an endangered form. It would be unthinkable in areas where the Whooping Crane would be endangered. Following the experimental season of last winter, there are already pressures for crane hunting seasons in other western states and in Alaska.

It is gratifying to note that in some instances industrial concerns have shown recognition of conservation needs, especially with respect to the provision of refuge sites. The American Cyanamid Company recently announced the lease of 1,000 acres of land as a wading-bird sanctuary to the Florida Audubon Society. The new refuge has been named the Saddle Creek Bird Sanctuary and will be posted with signs reading, "Florida Audubon Society, American Cyanamid Company Cooperating." This project is especially encouraging because of the marked decline in populations of Common Egrets and Wood Ibises over the past 10 years.

Of major importance in wildlife conservation nationally was the signing on 7 December 1960, by outgoing Secretary of the Interior Fred A. Seaton, of land withdrawal orders establishing three new National Wildlife Ranges in Alaska with a total area of more than 11 million acres. The Arctic National Wildlife Range of approximately 9 million acres in northeast Alaska contains nesting ground for approximately a hundred species of birds, and provides range for grizzly and polar bears, Dall sheep, wolverine, caribou, and other wildlife. The Kuskokwim National Wildlife Range, 1.8 million acres in western Alaska, is one of the most important breeding grounds for migratory birds in North America. The Izembek National Wildlife Refuge, approximately 400,000 acres near the western end of Alaska, is a vital concentration area for migratory waterfowl where large amounts of aquatic food are available. (*Natl. Aud. Soc. News and Views and Leader's Cons. Guide*, 15 December 1960).

The Alaska Conservation Society, in its News Bulletin of January 1961, states editorially that the action establishing the Arctic National Wildlife Range by the former Secretary of the Interior received high praise from Alaskan sportsmen and conservation groups who had long advocated this reserve in northeast Alaska. The action was bitterly condemned, however, by Alaska's Senators Edward L. Bartlett and Ernest H.

Gruening, Representative Ralph J. Rivers, and Governor William A. Egan. Belief was expressed that the new Secretary of the Interior, Stewart L. Udall, would be under strong pressure to rescind the proclamation (*Alaska Cons. Soc. News Bull.* 2(1):3–4, 1961).

Wilderness bills were introduced both in the House and Senate at the beginning of the 87th Congress. Senator Clinton P. Anderson of New Mexico introduced what he described as a "streamlined version of a bill to establish a National Wilderness Preservation system." This bill, S. 174, was referred to the Senate Committee on Interior and Insular Affairs of which Senator Anderson is chairman. The bill was first introduced five years ago. The Senate Committee on Interior and Insular Affairs gave it extensive consideration in hearings, and revisions are said to have met objections of most groups. Senator Anderson stated: "After four years of such constructive revision and in response to an increasing public support and a deep sense of urgency in our realization that we must act promptly or run the risk of losing much of our opportunity, it seems to me we should now proceed to act" (*Nat. Res. Council of Am., Legislative News Service*, Rept. No. 1:7, 13 January 1961).

Amendment of the Migratory Bird Hunting Stamp Act to require all receipts except those for reimbursement to the Post Office to be expended for the lease and acquisition of nesting and refuge areas is beginning to result in acquisition of land. Another step was made in the uphill fight to save waterfowl habitat from encroachment by agriculture when 14,641 acres of Klamath Marsh, Oregon, were purchased by the Department of the Interior. All of the purchase price of $476,401 came from the Migratory Bird Hunting Stamp Act money (*Nat. Res. Council of Am., Executive News Service* 3(9):76, 1960). Progress with acquistion, however, is limited by funds. Doubt was expressed in an earlier report of the Conservation Committee that the amendment of the Stamp Act would provide the necessary acceleration (Scott, 1958:388). Thus it is most encouraging to learn that $150 million for acquisition of waterfowl wetlands is being sought in bills (H.R. 4603 and H.R. 4624) introduced by Congressmen John D. Dingell (Mich.) and Henry S. Reuss (Wis.). The bills would make up to $20 million available annually over a period of 10 years. It should be remembered, however, that unless authority is granted to spend some of the funds in Canada, the bill will not aid in the preservation of the breeding areas that produce most of the ducks in North America.

A gratifying awareness of the serious contradictions in policies of federal agencies and of the need for prompt action to save duck nesting habitat is evident in the excerpt quoted herewith from President John F. Kennedy's conservation program outlined in his message to Congress of 23 February 1961: "I am also hopeful that consistent and coordinated Federal leadership can expand our fish and wildlife opportunities without the present conflicts of agencies and interests: One department paying to have wetlands drained for agricultural purposes while another is purchasing such lands for wildlife or waterfowl refuges—one agency encouraging chemical pesticides that may harm the songbirds and game birds whose preservation is encouraged by another agency—conflicts between private landowners and sportsmen—uncertain responsibility for the watershed and anti-pollution programs that are vital to our fish and wildlife opportunities.

"I am directing the Secretary of the Interior to take the lead, with other Federal and State officials, to end these conflicts and develop a long-range wildlife conservation program—and to accelerate the acquisition of upper Midwest wetlands through the sale of Federal duck stamps" (*Nat. Res. Council of Am., Legislative News Service*, Rept. No. 8:95, 2 March 1961).

HABITAT POLLUTION

The application of extremely toxic pesticides, the accidental dumping of oil into aquatic habitats, the silting of water areas with eroded soil, and general pollution of waterways with industrial and residential wastes present an extremely sensitive problem that must be controlled in some reasonable fashion. Here again, the ornithologist can protect his interests only by aggressively engaging in research on these pollution problems, being alert to conditions in his region, and encouraging needed action.

The 86th Congress voted the usual $2.4 million for the fire-ant spraying program during the fiscal year of 1961; however, the Senate Appropriations Committee, in approving the appropriation, tied on the following string: "The Committee directs that no funds provided herein are to be used to carry out the fire-ant eradication program in any state which does not provide its share of the financing" (*Natl. Aud. Soc., News and Views and Leader's Cons. Guide* 1(4), 1960).

Because large losses of wildlife have been proved beyond doubt to result from similar applications of poison, the conclusions of the National Audubon Society in regard to actions that must be taken to meet the pesticides problem seem sound. They are quoted from the *Natl. Aud. Soc. News and Views and Leader's Cons. Guide* of 1 November 1960:

"1. Research must be stepped up sharply. Research to show what new chemicals will and will not do, in the short run and in the long run, before they are placed on the market or fogged onto the land in government spraying operations. Research also to discover selective chemicals to replace the present broad-spectrum poisons now in common use, and to discover alternative, and safe, biological and cultural controls for economic pests.

"2. New laws are needed to regulate the distribution and sale of chemical pesticides, to regulate their use by public agencies such as the U.S. Department of Agriculture's plant pest control division, and to license and regulate persons engaged in commercial or contract spraying operations.

"3. Educational efforts can alert the public to the dangers involved in the unwise application of poisons that have not been fully studied, and in the excessive or careless use of tested poisons."

Another quotation, from Dr. Samuel A. Graham (1960), Emeritus Professor of Economic Entomology, University of Michigan, deserves careful consideration:

"...the use of insecticides is a necessity for production of foods in the quantity and quality we require. However, numerous widespread projects involving the broadcasting of insecticides that have been endorsed enthusiastically by the public-supported control agencies, are open to question. Apparently the decision to spray or not to spray cannot be safely left to these control agencies. The temptations of empire building are too great. The pros and cons should be weighed by persons with broad training and experience, who can evaluate all available information dispassionately, thus reaching a decision that will be in the best long-term interest of mankind and as nearly unbiased as possible. The viewpoint of forest entomologists on the broadcasting of insecticides deserves special comment because it is the sensible one. It is this: All agree that the application of insecticides over large areas must be regarded as emergency treatment, comparable to extinguishing a fire or removing a man's appendix. Control projects involving the broadcasting of insecticides should not be entered upon lightly."

The National Academy of Sciences-National Research Council designated a committee to investigate problems associated with the chemical control of agricultural pests. A news release from the National Academy of Sciences-National Research Council, dated for release 15 June 1960, stated that the work of the committee would endeavor to:

"1. provide technical advice and guidance to bring about maximum control of crop pests with minimum damage to wildlife,

"2. provide critical evaluation of both the direct and indirect effects of various pest control operations on plants and animals,

"3. stimulate new research where gaps exist, and encourage investigations in progress to obtain factual information as a basis for sound guiding principles and policy determinations, and

"4. foster cooperation among various agencies, organizations, industries, and individuals interested in pest control and those concerned with its effects on fish and wildlife."

The scientists designated to serve on the committee were obviously highly qualified in their fields, but their fields of experience are so closely allied to the problem that some question may be raised as to whether some might not have provided greater service as witnesses than as judges. It is to be hoped that their work will not reflect the potential biases indicated by their backgrounds.

In these times when international good will is so important, the long delay attending ratification of the oil pollution control treaty, officially known as the *International Convention for Prevention of the Pollution of the Sea by Oil*, by the United States has been beyond comprehension. This treaty was drafted seven years ago with U. S. State Department representatives participating. The United States, with about 15 per cent of the world's tanker tonnage, has been the major holdout. The Constitution requires a two-thirds favorable vote of the Senate for approval of international treaties of this kind. Although the Committee on Foreign Relations voted favorably on the treaty on 2 June 1960, the Senate stalled off a vote on this important treaty. On 3 January 1961, the treaty was re-referred to the Committee on Foreign Relations which again voted favorably on it. Finally, on 16 May 1961, the treaty was approved by the Senate. It is our understanding, however, that the treaty will not be formally ratified by the United States internationally until the President and Department of State have obtained legislation to implement it. It is reported that implementing legislation is now under consideration.

CONTROL OF BIRD POPULATIONS

This problem promises to become increasingly important. Concern for bird control reaches spectacular proportions in localities where birds have caused planes to crash. Wherever bird depredations on crops occur there are demands for control measures, and the degree of urgency of such control relates directly to the importance of the crop loss and to the need for increasing food production for livestock and humans. Also, diseases and parasites of livestock and man which find feral hosts among birds stimulate attempts to control birds. The frightening epidemic resulting in 21 human deaths from Eastern Encephalitis in New Jersey in the late summer and fall of 1959 is a case in point, because wild birds were implicated as reservoir hosts. Of the ornithologist's responsibility here, Stamm (1960:5–6) wrote: "Ornithologists must take a much more active role in relating available knowledge to the problems and in developing new approaches. The areas which, at the moment, seem most needful of clarification are (1) the precise trends in bird population density in affected areas during the epidemic season, and (2) the influence of human alteration of habitat on population density. Ornithologists have a special stake in these activities for several reasons. Their knowledge of the host species is essential to solving the EE disease problem. Knowledge gained in studies of this disease will also be applicable to other diseases affecting birds only. Most important, ornithologists must be aware of the details of and basis for possible bird population reduction as a means of epidemic control. Only by direct participation in the basic

work can they be assured that harm to bird populations will not result either from overt activity of this sort or potentially even more severe damage as a result of uncritical massive application of chemicals for 'mosquito control.'"

Reports of damage by blackbirds to crops seem to have increased with the spread of the Starling westward. Starlings readily flock with Red-winged Blackbirds, Cowbirds, and other blackbirds, sometimes forming huge roosts. Instances of aerial application of parathion to kill birds in roosts are cited by Dykstra (1960), who states that this matter is of serious concern to the Bureau of Sport Fisheries and Wildlife, partly because of the hazard to humans.

ENDANGERED SPECIES AND SUBSPECIES

At least nine birds native to North America, neighboring islands of the Atlantic Ocean, and American possessions in the Pacific were mentioned during the 1949 meeting of the International Union for the Protection of Nature as on the verge of extermination. Of the seven of these birds on which we have some recent data or opinions, the Eskimo Curlew may be extinct; and the Ivory-billed Woodpecker was down to 12 known birds in Oriente Province, Cuba, by July 1956 (Lamb, 1957*a*). Three others are holding their own, although in low numbers (California Condor, Whooping Crane, and Bermuda Petrel). Two others have staged comebacks (Hawaiian Goose and Laysan Mallard), although the singularly insular condition of the Laysan Mallards continues to render them vulnerable to local catastrophes. Conservation programs are also playing a part in the survival of the California Condor, Whooping Crane, and Bermuda Petrel. There have been no recent reports of the Marianas Mallard or the Marianas Megapode.

There is good reason to feel that management measures must now be taken to preserve such interesting subspecies as the Hawaiian Stilt, whose breeding grounds are being steadily eliminated, and the Hawaiian Duck (or Koloa) if they are to be preserved at all.

It is urgent that action be taken to provide an effective program for the conservation of birdlife in the Virgin Islands, especially the nesting colonies of 17 kinds of sea birds on local cays (leased by the government to private individuals) where the eggs and young birds are reported to be exploited commercially (Lamb, 1957b). By 1957, White-crowned Pigeons had been reduced by excessive hunting and reduction of habitat to a single colony of 300 on St. Croix Island. The United States has shown scant and ineffective interest in the protection of birdlife in the Virgin Islands. On 15 May 1961, the Legislative Assembly of the Virgin Islands passed Bill No. 1395, making legal the "removal or possession of eggs of the birds commonly known as 'Boobies.'" This means the eggs of such birds as Sooty Terns, Bridled Terns, Laughing Gulls, Boobies, and similar species.

In Texas, the Attwater's Prairie Chicken is estimated to number no more than 3,000 individuals, and no management plan has been worked out for their preservation since Lehmann's pioneer study in 1941 (Towell, 1958).

In Florida, the Everglade Kite is about to be extirpated as a native of the United States. In the southeastern states, the Bachman's Warbler appears to be a dying species, and in Sonora, overgrazing is steadily leading to the disappearance of the Masked Bobwhite (Ligon, 1952; Leopold, 1959). This bobwhite apparently has been extirpated in Arizona. The forthcoming attempt by the Arizona-Sonora Desert Museum to stock an area near Tucson with pen-reared Masked Bobwhites will be of much interest. On the Edwards Plateau, where goats now compete for forage with sheep, steers, and deer, a careful census or estimate of the population of the Golden-cheeked Warbler is urgently needed. And our

TABLE 1

AMERICAN RESEARCH PRIORITIES ON RARE AND VANISHING BIRDS

Status	Species	Subspecies
Critical but holding own	Bermuda Petrel	Hawaiian Duck
	Whooping Crane*	Laysan Mallard
	Hawaiian Goose*	
	California Condor*	
	Cape Sable Sparrow*	
Probably in danger	Bachman's Warbler	Hawaiian Stilt
	Kirtland's Warbler*	Attwater's Prairie Chicken
	Puaiohi (Small Kauai Thrush)	Masked Bobwhite
	Ooaa (Kauai Oo)	
	Kauai Akioloa	
Population trend unknown	Golden-cheeked Warbler	
	Nukupuu	
	Maui Parrotbill	
	Noguchi's Woodpecker	

* Birds subjected to adequate ecological study in the last decade.

military occupation of Okinawa should not mean that we assume no responsibility for the preservation of Noguchi's Woodpecker.

In general, an important responsibility for ornithologists in the 1960's is to carry out good ecological studies of at least the species and subspecies listed in Table 1 in order to establish population trends, ascertain limiting factors, and provide sound recommendations for conservation programs.

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WOS CONSERVATION COMMITTEE
THOMAS G. SCOTT, *Chairman*
CHARLES H. CALLISON
JOSEPH J. HICKEY
LAURENCE R. JAHN
JOHNSON A. NEFF
RALPH E. YEATTER

PROCEEDINGS OF THE FORTY-SECOND ANNUAL MEETING

AARON M. BAGG, SECRETARY

The Forty-second Annual Meeting of the Wilson Ornithological Society was held at the Britannia Hotel, Huntsville, Ontario, from Thursday, 8 June, to Sunday, 11 June 1961. The meeting was sponsored by The Audubon Society of Canada, The Federation of Ontario Naturalists, and The Royal Ontario Museum. The Local Committee, under the energetic and enthusiastic direction of Dr. J. Murray Speirs, Chairman, made this—the Society's first Canadian meeting—a truly enjoyable and memorable one for the 250 members and guests who attended.

Four sessions were devoted to papers, and two business meetings were held, in the Pavilion of Britannia Hotel, in beautiful surroundings on the Lake of Bays. The meeting opened with an informal reception on Thursday evening, at which the Huntsville Nature Club acted as hosts, and Dr. W. W. H. Gunn presented recordings of warbler songs. The Executive Council also met, Thursday evening, at Britannia Hotel. And there was an evening field trip (repeated on Friday) into Algonquin Park to listen for timber wolves. On Friday evening there was an informal showing of several excellent films. The Annual Dinner was held on Saturday evening at Britannia Hotel, with Harold F. Mayfield presenting the President's Address. This was followed by two outstanding color films by Dr. Roger T. Peterson, *A Gathering of Storks*, and a film by Dr. Peterson made in Africa. The Local Committee had decorated the tables attractively at the dinner, and at each place setting there was a souvenir strip containing color slides of four characteristic birds of the Algonquin Park region in which the meeting was held: Spruce Grouse, Black-backed Three-toed Woodpecker, Gray Jay, and Common Raven.

Early-morning field trips were scheduled for Friday and Saturday. On Sunday, there were field trips into Algonquin Park.

First Business Session

President Mayfield called the meeting to order at 9:00 AM, Friday, 9 June. Welcoming addresses, on behalf of The Audubon Society of Canada, The Federation of Ontario Naturalists, and The Royal Ontario Museum, were made by John A. Livingston, William W. W. H. Gunn, and James Baillie, respectively. President Mayfield responded on behalf of the Society.

The Proceedings of the Forty-first Annual Meeting were approved as published in *The Wilson Bulletin* for September 1960.

Secretary's Report

The secretary, Aaron M. Bagg, summarized the principal actions taken at the Thursday evening meeting of the Executive Council, as follows:

1. The Council voted to accept the invitation of Purdue University and the Indiana Audubon Society, to the Wilson Society, to hold its 1962 meeting at Purdue University during 5–8 April 1962.
2. The Council voted to accept the invitation of the Charleston Museum, the Charleston Natural History Society, and the Carolina Bird Club, to the Wilson Society, to hold its 1963 meeting at Charleston, S.C., during 2–5 May 1963.
3. The Council voted to look with favor upon, and to explore the possibilities of, an invitation to the Wilson Society to hold its 1964 meeting in Kalamazoo, Michigan, in June 1964.
4. The Council re-elected H. Lewis Batts, Jr., as Editor of *The Wilson Bulletin*.
5. Following the recommendation of the Fuertes Research Grant Committee, the Council

voted a grant of $100.00 to Mrs. Frances Crews James to assist in her study of the birds of Arkansas.

Treasurer's Report

The treasurer, Merrill Wood, submitted the following report on the finances of the Society:

REPORT OF THE TREASURER FOR 1960

GENERAL FUND

Balance as shown by last report dated 31 December 1959			$ 4,305.51
RECEIPTS			
Dues:			
Active Memberships	$5,005.84		
Sustaining Memberships	792.00	$5,797.84	
Subscriptions to *The Wilson Bulletin*		995.25	
Sale of back issues of *The Wilson Bulletin*		370.45	
Interest and dividends on savings and investments		1,121.25	
Gifts		20.10	
Miscellaneous		482.37	8,787.26
Total receipts			$13,092.77
DISBURSEMENTS			
The Wilson Bulletin (printing and engraving)		$7,109.47	
The Wilson Bulletin (mailing and maintenance of mailing)		770.95	
Editor's expense		194.56	
Treasurer's expense (printing, postage, safe deposit box)		206.87	
Back issue expense (postage)		52.92	
Committee expense (Memberships and Endowment)		72.43	
Annual Meeting expense		255.31	
Miscellaneous		4.00	
Total disbursements			$ 8,666.51
Balance on hand in First National Bank, State College, Pennsylvania, 31 December 1960			4,426.26

JOSSELYN VAN TYNE MEMORIAL LIBRARY BOOK FUND

Balance as shown by last report dated 31 December 1959			$ 283.41
RECEIPTS			
Sale of duplicates		$ 9.00	
Gifts		46.00	
Total receipts			$ 338.41
DISBURSEMENTS			
Purchase of books		$ 38.25	38.25
Balance on hand in First National Bank, State College, Pennsylvania, 31 December 1960			$ 300.16

LOUIS AGASSIZ FUERTES RESEARCH FUND

Balance as shown by last report dated 31 December 1959			$ 225.00
RECEIPTS			
Contributions		$ 2.00	2.00
Total receipts			$ 227.00

DISBURSEMENTS

Award to Mr. Robert T. Lynn	$ 100.00	100.00
Balance on hand in First National Bank, State College, Pennsylvania, 31 December 1960		$ 127.00

Special Publications Fund

Balance as shown by last report dated 31 December 1959		none
RECEIPTS		
Contributions		$ 4.00
DISBURSEMENTS		none
Balance on hand in First National Bank, State College, Pennsylvania, 31 December 1960		$ 4.00

Endowment Fund

Balance in Savings Account as shown by last report, dated 31 December 1959		$ 3,775.98
RECEIPTS		
Life Membership payments	$2,335.00	2,335.00
Stock dividends received (included below)		
5 shares Massachusetts Investors Trust		
Total receipts		$ 6,110.98
DISBURSEMENTS		
Purchase of 12½ shares Fireman's Fund Insurance	$ 674.63	
Purchase of $3,000 Phillips Petroleum 4¼% Bonds due 15 February 1987	3,347.69	
Total disbursements		$ 4,022.32
Balance in Savings Account, First National Bank, State College, Pennsylvania, 31 December 1960		$ 2,088.66
Total		$ 6,110.98

SECURITIES OWNED

$5,000 U.S. Treas. 4% Notes due 15 May 1963 at 102¼	$5,112.50	
$5,000 U.S. Treas. 4% Bonds due 1 October 1969 at 103	5,150.00	
$3,000 Phillips Petroleum 4¼% Bonds due 15 February 1987 at 115½	3,465.00	
15 shares Kaiser Aluminum & Chemical Co. 4¾% cum. cvt. pfd. at 104½	1,567.50	
396 shares Massachusetts Investors Trust at 13.35	5,286.60	
100 shares Fireman's Fund Insurance at 54	5,400.00	
25 shares Owens-Illinois Glass Co. 4% cum. pfd. at 116¾	2,918.75	
(Securities listed at closing prices 30 December 1960)		
Total securities owned		$28,900.35
Total in Endowment Fund, 31 December 1960		$30,989.01

Respectfully submitted,

/s/ Merrill Wood
Treasurer

Research Grant Committee

Harvey I. Fisher, chairman, reported by letter that the Committee recommended Mrs. Frances Crews James for the Louis Agassiz Fuertes Grant for the current year. Mr. Donald Heintzelman was second choice. The report was accepted and approved.

Membership Committee

Hazel Bradley Lory, chairman, reported by letter as follows:

The membership committee this year has consisted of seventeen members and myself. These members have been supplied with application blanks and leaflets about the Society, also with back numbers of *The Wilson Bulletin* where they had use for them. They have been urged to make personal contacts, to check on College and University Library subscriptions wherever possible, and, in some cases, supplied with names and addresses of people attending last year's annual meeting who were not already members.

Members of the committee wrote to 60 people who attended the 1960 meeting and from them obtained a few new members. We might have gained a few more if we could have had addresses for the 55 other non-members who were registered. I would like to suggest that the membership chairman be supplied with a complete list of those registered at each annual meeting (together with the addresses) soon after each annual meeting. Such a list could then be checked with the most recent membership list and names of prospective members be secured. I have already asked Mrs. Speirs, a member of this committee to see that this is done for the Ontario meeting.

The Head Biologist of the Soil Conservation Service sent in the names of 23 Soil Conservation Service Biologists, saying he thought they should all be interested in joining our Society. I, personally, wrote to these men and a few of them signed up as members.

At last year's council meeting, it was suggested that back numbers of *The Wilson Bulletin* be used to send to prospective members. To that end, I went to Ann Arbor and picked up a supply of recent numbers. I still have a good supply on hand, though many of them have been used in this way.

I wish to extend thanks to all who have helped in this work, not only the members of my committee, but also to the many members outside the committee who are helping by recommending those people they know to be interested.

Library Committee

William A. Lunk, chairman, reported by letter as follows:

The past year, for the Library Committee, has shown continued very satisfactory progress, though without spectacular developments or innovations. It is encouraging to note a continued rise in contributions to the library's collections, when present figures are compared with those of last year.

Our oversupply of certain back issues of *The Wilson Bulletin* has been reduced by the transfer of 500 copies to Mrs. Hazel Lory for use by the Membership Committee. It is to be hoped that this plan will not only alleviate the storage problem, but put the *Bulletin* copies to good use in publicizing our organization and its journal.

Another segment of the late Josselyn Van Tyne's collection, gift from Mrs. Van Tyne, totaling 56 bound volumes and the equivalent of some 56 volumes of reprints and separates, was accepted. The balance, on permanent loan, remains available to members.

Eighty-two other gifts to the library, from 66 individuals and institutions, comprised an additional total of 71 books, 186 journals, 61 pamphlets, 628 reprints, 55 newsletters, and 11 translations. One hundred and seven journals (82 by exchange and 25 as gifts) are currently being received.

Approximately 35 out-of-town loans, of about 140 items, were made during the year. This figure seems low. It does not, of course, reflect the great amount of on-the-spot use being made of the library. Members the country over, however, should be encouraged to make more use of our facilities, both for their research documentation and for their leisure-time reading.

The close association between the Josselyn Van Tyne Memorial Library and that of the Bird Division, Museum of Zoology, University of Michigan, deserves special notice. Without the storage facilities and clerical help provided by the University, it is doubtful whether our library could function. To some extent, and for the benefit of both, holdings of the two libraries are kept complementary (particularly where serials are concerned). Within limits, Bird Division materials are available for Wilson Society loans. Revised shelving arrangements, worked out by Bird Division personnel, have now put nearly all of the Wilson Ornithological Society holdings, exclusive of serials, in a separate room. Special categories, such as bibliography, biography, and regional works, are shelved together for convenient reference. Norman Ford, Technical Aide, is largely responsible for correspondence and for routine library business.

Contributions and proceeds from the sale of duplicates continue to augment the Society's New Book Fund, this being drawn upon from time to time to add important items not otherwise acquired.

Attention of the members is drawn to the availability of reasonably priced items from our duplicate collections, and to the always-present need for donations. Cooperation and assistance in all forms are welcomed.

Second Business Session

The final business session was called to order at 3:15 PM, Saturday, 10 June.

On motion duly made and seconded, the report of the Membership Committee was accepted, and the candidates were elected to membership in the Society.

President Mayfield called upon the editor of the *Bulletin*, H. Lewis Batts, Jr., to speak. Dr. Batts commended the editorial board (Bartholomew, Berger, Gunn, Lunk, Norris, Parkes, Paynter, and Pettingill) for their valued services; he also invited prospective authors to submit manuscripts to the *Bulletin* after consulting the new "Style Manual for Biological Journals," and asked members to offer suggestions about the *Bulletin*.

Maurice Brooks summarized the excellent report of the Conservation Committee. (See pages 312–321.)

Report of the Auditing Committee

Stephen Eaton reported in the absence of David E. Davis, chairman, that the books of the treasurer, Mr. Merrill Wood, had been examined and found in good order. The Auditing Committee "was unanimous in complimenting Mr. Wood on the conscientious work he has done."

On motion duly made and seconded, the report of the Auditing Committee was accepted.

Report of the Resolutions Committee

George Hall, chairman, read the following report:

WHEREAS, The Wilson Ornithological Society at its Forty-second Annual Meeting at Huntsville, Ontario, has enjoyed the cordial hospitality of the sponsoring organizations, of the Huntsville Nature Club, of the Britannia Hotel, and of the Ontario Departments of Lands and Forests and of Travel and Publicity, and has enjoyed the beautiful environment of the meeting place and of Algonquin Provincial Park, and

WHEREAS the Local Committee on Arrangements has unstintingly provided for our comfort, amusement and education,

BE IT RESOLVED that the Members of the Wilson Ornithological Society attending this meeting express to the sponsoring organizations, The Audubon Society of Canada, The Federation of Ontario Naturalists, and the Royal Ontario Museum and to the Huntsville Nature Club, the staff of the Britannia Hotel, and to the Ontario Departments of Lands and Forests and Travel and Publicity, and particularly to the Local Committee on Arrangements, ably chaired by Dr. J. Murray Speirs, their deep appreciation and gratitude for all that has been done to make this meeting so memorable.

WHEREAS the Members of the Wilson Ornithological Society, an international organization are deeply interested in the conservation of North American waterfowl, and

WHEREAS this problem is international in scope,

BE IT RESOLVED that the Society go on record as favoring the authorization by the Congress of the United States of America for the allocation of part of the funds available for the purchase of Wetlands, to the acquisition of waterfowl breeding areas in Canada; and

BE IT FURTHER RESOLVED that the secretary be instructed to make the position of the Society known to the proper Government agencies.

On motion duly made and seconded, the report of the Resolutions Committee was accepted.

Election of Officers

Joseph Howell read the report of the Nominating Committee, which proposed the following officers for the coming year: President, Harold F. Mayfield; First Vice-President, Phillips B. Street; Second Vice-President, Roger Tory Peterson; Secretary, Aaron M. Bagg; Treasurer, Merrill Wood; Elective Member of the Executive Council, J. Bruce Falls (term expiring 1964).

The report of the committee being accepted, and there being no nominations from the floor, the secretary was instructed to cast a unanimous ballot for these nominees.

Papers Sessions

Friday, 9 June

1. James Baillie, Royal Ontario Museum. *Ontario's First Naturalists*, slides.
2. Laszlo J. Szijj, University of Toronto. *A Study of Meadowlark Vocalizations in Ontario*, slides, tape.
3. J. Bruce Falls, University of Toronto. *What Makes a Bird's Song Recognizable to Other Members of the Same Species?* slides, tape.
4. Grant Tayler, Algonquin Park, Ontario. *Algonquin Park*, slides.
5. Walter R. Spofford, State University of New York Medical College, Syracuse, New York. *White Epaulettes in Some Appalachian Golden Eagles*, slides.
6. D. J. T. Hussell, Weston, Ontario. *Long Point Bird Observatory*, color film.
7. Walter P. Nickell, Cranbrook Institute of Science, Bloomfield Hills, Michigan. *Net Banding: An Effective Method of Determining Distribution of Northern Migrants in Their Winter Ranges*, slides.
8. Daniel D. Berger and Helmut C. Mueller, Cedar Grove Ornithological Station, Wisconsin, and Frances Hamerstrom, University of Wisconsin. *Banding Snowy Owls in Wisconsin*, slides.
9. James Woodford, Royal Ontario Museum. *Operation Recovery—Great Lakes Region*, slides.

10. Bertram G. Murray, Jr., Douglas College, Rutgers—The State University, New Brunswick, New Jersey. *Fall Hawk Migration along the Coastal Areas of the Northeastern United States*, slides
11. James Baird, Massachusetts Audubon Society. *Summer Weights of Evening Grosbeaks*, slides.
12. James K. Lowther, University of Toronto. *Polymorphism in the White-throated Sparrow*, Zonotrichia albicollis (*Gmelin*), slides.

Saturday, 10 June

13. Norman Duncan Martin, Commonwealth Laboratory, Gore's Landing, Ontario. *Why Do Birds Show Vegetation Preferences?*
14. Louise de Kiriline Lawrence, Rutherglen, Ontario. *The Displays and Courtship of the Yellow-bellied Sapsucker* (Sphyrapicus varius).
15. Heinz Meng, State University College of Education, New Paltz, New York. *The Breeding Behavior of the Goshawk*, color film.
16. Robert W. Storer, Museum of Zoology, The University of Michigan. *Platform Behavior of the Horned, Eared, and Red-necked Grebes*, color film.
17. John L. Zimmerman, University of Illinois. *The Nest Guarding Behavior of the Male Catbird*, slides.
18. Ralph W. Dexter, Kent State University, Kent, Ohio. *Life History of a Thirteen-year-old Chimney Swift*, slides.
19. George Hills Kelker, Utah State University. *A Mathematical Estimation of Species Survival of the Condor, Whooping Crane, and Ivory-billed Woodpecker.*
20. L. M. Bartlett, University of Massachusetts. *Responses of Some Blackbirds to Phenylthiourea*, slides.
21. Glen E. Woolfenden, University of South Florida. *Osteology and the Systematic Position of the Mergansers*, slides.
22. J. Dan Webster, Hanover College, Indiana, and The California Academy of Sciences. *The Systematic Position of the Olive Warbler*, slides.
23. Fred T. Hall, Buffalo Museum of Science. *Birds of the Border*, color film.
24. Lawrence I. Grinnell, Cornell Laboratory of Ornithology, Ithaca, New York. *Australia Outback*, color film.
25. Gordon Bennett, Wildlife Research Station, Algonquin Park, Ontario. *Interrelations of Vector and Host in the Transmission of Some Avian Blood Parasites*, slides.

Attendance

Members and guests who attended totaled 250 persons. Twenty states, Ontario, Quebec, and Saskatchewan were represented.

From **California:** 1—*Dunmore*, Elizabeth A. Taft.

From **Connecticut:** 6—*Greenwich*, Mr. and Mrs. John C. Schmid; *Old Lyme*, Mr. and Mrs. Roger T. Peterson, Tory C. Peterson; *West Hartford*, E. Alexander Bergstrom.

From **Florida:** 3—*Daytona Beach*, Mr. and Mrs. C. H. Ekdahl; *Tampa*, Glen E. Woolfenden.

From **Georgia:** 1—*Athens*, Philip Kahl.

From **Illinois:** 15—*Blue Island*, Karl E. Bartel; *Champaign*, John L. Zimmerman; *Chicago*, Mrs. Amy G. Baldwin, William J. Beecher, Helen Horton, M. Lehmann, Margaret M. Nice, Paul A. Schulze; *DeKalb*, William E. Southern, James Tate, Jr.; *River Forest*, Mrs. I. B. Wasson, Charles A. Westcott; *Urbana*, Tom C. Jegla, Elden Martin, Ralph E. Yeatter.

From **Indiana:** 2—*Hanover*, J. Dan Webster; *Lafayette*, Russell E. Mumford.

From **Iowa:** 2—*Cedar Rapids*, Lillian Serbousek, Myra G. Willis.

From **Louisiana:** 2—*Thibodaux*, Mrs. Electra D. Levi, Ava R. Tabor.

From **Massachusetts:** 4—*Amherst*, Lawrence M. Bartlett; *Dover*, Mr. and Mrs. Aaron M. Bagg; *Wayland*, James Baird.

From **Michigan:** 26—*Albion*, Danny Dillery, Dean G. Dillery, Clara Dixon; *Ann Arbor*, Mr. and Mrs. Ralph Branch, Haven H. Spencer, Robert W. Storer, Harrison B. Tordoff; *Bloomfield Hills*, Walter P. Nickell; *Dearborn*, Mr. and Mrs. Joseph T. Woolfenden; *Grand Rapids*, Spencer Holmes, Bob Murray; *Grayling*, Mr. and Mrs. Fenn Holden; *Kalamazoo*, H. Lewis Batts, Jr., Judy Centa, Judy Cooper, Monica Ann Evans, Richard Koerker, Theodore List, Tracy Newkirk, James Spaulding; *Leonard*, Mrs. Don S. Miller; *Marquette*, Mrs. Mary Spear Ross; *Warren*, Sergej Postupalsky.

From **New Jersey:** 16—*Audubon*, Mr. and Mrs. Clarence E. Stasz, James Stasz; *Bound Brook*, Bertram G. Murray; *Clifton*, Joseph R. Jehl, Jr.; *Jamesburg*, Jeff Swineboard; *Maplewood*, Ann Chamberlain, Mrs. Richard R. Chamberlain; *Mountainside*, Mr. and Mrs. Albert Schnitzer; *New Brunswick*, Thomas C. Crebbs, Jr.; *Ramsey*, Mrs. Eleanor E. Dater; *Spotswood*, Mr. and Mrs. Stanley S. Dickerson; *Upper Montclair*, Charles W. Lincoln; *Westfield*, Norman B. Pilling.

From **New York:** 15—*Albany*, Mrs. Dayton Stoner; *Allegany*, Mr. and Mrs. Stephen W. Eaton, David Krieg; *Buffalo*, Harold H. Axtell, Fred T. Hall, G. John Lehrer, Richard C. Rosche, Edwin L. Seeber, Mr. and Mrs. Edward C. Ulrich; *Canton*, Robert G. Wolk; *Hornell*, Mr. and Mrs. William M. Groesbeck; *Ithaca*, Lawrence I. Grinnell, Barbara Ann Lund; *Long Island*, Lester L. Short, Jr.; *New Paltz*, Dr. and Mrs. Heinz Meng; *Olean*, Rev. Patrick D. D. Connor; *Syracuse*, Walter R. Spofford; *Williamsville*, Mr. and Mrs. H. D. Mitchell.

From **Ohio:** 21—*Ashtabula*, Howard E. Blakeslee; *Cincinnati*, Emerson Kemsies, Mr. and Mrs. Howard P. Walding, Jr.; *Cleveland*, Helen M. Focke, Adela Gaede, Eugene S. Morton, Mildred Stewart; *Columbus*, W. Todd Furniss; *Cuyahoga Falls*, J. Neil Henderson; *Dayton*, Kenneth L. Meyers; *Kent*, Mr. and Mrs. Ralph W. Dexter; *Lakewood*, Mr. and Mrs. William A. Klamm; *Madison*, Mrs. Bernice Dodge, Howard Walding; *Painesville*, Mrs. Robert V. D. Booth; *Toledo*, Dr. Miriam Bell, Robert Crofts; *Waterville*, Harold Mayfield.

From **Pennsylvania:** 10—*Allport*, Elsie Erickson; *Chester Springs*, Phillips B. Street; *Philadelphia*, C. Chandler Ross; *Pittsburgh*, Dr. and Mrs. Kenneth C. Parkes; *State College*, Mr. and Mrs. Earl R. Bordner, Dorothy Bordner; *University Park*, Dr. and Mrs. Merrill Wood.

From **South Dakota:** 2—*Sioux Falls*, Mr. and Mrs. J. Scott Findley.

From **Tennessee:** 3—*Knoxville*, Mr. and Mrs. J. C. Howell; *Nashville*, Amelia R. Laskey.

From **Utah:** 1—*Logan*, George H. Kelker.

From **Vermont:** 3—*Bennington*, Thomas H. Foster; *South Londonderry*, Mr. and Mrs. James R. Downs.

From **West Virginia:** 4—*Morgantown*, Mr. and Mrs. Maurice Brooks, George A. Hall, Earl N. McCue.

From **Wisconsin:** 10—*Beloit*, Carl Welty; *Cedar Grove*, Daniel D. Berger; *Madison*, Mr. and Mrs. Helmut C. Mueller, Mr. and Mrs. Richard Penneng; *Plainfield*, Elva Hamerstrom, F. N. Hamerstrom, Frances Hamerstrom; *West Bend*, Marvin E. Vore.

From **Ontario:** 89—*Collingwood*, A. J. Mitchener; *Don Mills*, Mr. and Mrs. John Livingston, Dr. and Mrs. J. Bruce Falls; *Dorset*, L. F. Hess, W. A. Morris; *Ft. William*, Mr. and Mrs. Jack Murrie; *Gore's Landing*, N. D. Martin; *Guelph*, Mr. and Mrs. Alex Cringan; *Hamilton*, Eric W. Bastin, Robert H. Curry, George W. North; *Huntsville*,

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From **Quebec:** 4—*Montreal*, R. W. Stevenson; *Westmount*, John P. S. Mackenzie, Hon. Justice and Mrs. G. H. Montgomery, W. H. Rawlings.

From **Saskatchewan:** 1—*Regina*, Robert W. Nero.

No Address: Mrs. Gordon Hill.

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SUGGESTIONS TO AUTHORS

Manuscripts intended for publication in *The Wilson Bulletin* should be neatly typewritten, double-spaced, and on one side only of good quality white paper. Tables should be typed on separate sheets. Before preparing these, carefully consider whether the material is best presented in tabular form. Where the value of quantitative data can be enhanced by use of appropriate statistical methods, these should be used. Follow the AOU Check-list (Fifth Edition, 1957) insofar as scientific names of United States and Canadian birds are concerned unless a satisfactory explanation is offered for doing otherwise. Use species names (binomials) unless specimens have actually been handled and subspecifically identified. Summaries of major papers should be brief but quotable. Where fewer than five papers are cited, the citations may be included in the text. All citations in "General Notes" should be included in the text. Follow carefully the style used in this issue in listing the literature cited; otherwise, follow the "Style Manual for Biological Journals" (1960. AIBS). Photographs for illustrations should be sharp, have good contrast, and be on glossy paper. Submit prints unmounted and attach to each a brief but adequate legend. Do not write heavily on the backs of photographs. Diagrams and line drawings should be in black ink and their lettering large enough to permit reduction. Authors are requested to return proof promptly. Extensive alterations in copy after the type has been set must be charged to the author.

A WORD TO MEMBERS

The Wilson Bulletin is not as large as we want it to be. It will become larger as funds for publication increase. The Society loses money, and the size of the *Bulletin* is cut down accordingly, each time a member fails to pay dues and is put on the "suspended list." Postage is used in notifying the printer of this suspension. More postage is used in notifying the member and urging him to pay his dues. When he does finally pay he must be reinstated in the mailing list and there is a printer's charge for this service. The *Bulletin* will become larger if members will make a point of paying their dues promptly.

NOTICE OF CHANGE OF ADDRESS

If your address changes, notify the Society immediately. Send your complete new address to the Treasurer, Merrill Wood, Dept. of Zoology and Entomology, Frear Laboratory, Pennsylvania State University, University Park, Pennsylvania. He will notify the printer.

THE 1962 ANNUAL MEETING OF THE
WILSON ORNITHOLOGICAL SOCIETY
will be held on
the Campus of Purdue University at
Lafayette, Indiana
on 6–8 April